THE AUSTRALIAN NATIONAL UNIVERSITY
CRAWFORD SCHOOL OF ECONOMICS AND GOVERNEMENT

MONETARY TRANSMISSION MECHANISM IN VIETNAM AFTER THE ASIAN FINANCIAL CRISIS (1999-2006): A STRUCTURAL VECTOR AUTOREGRESSION MODEL

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The thesis submitted for the degree of Doctor of Philosophy of the Australian National University

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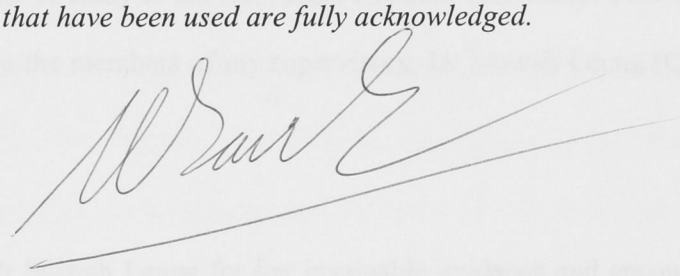
I hereby declare that this thesis is result of my own independent research and all authorities and sources that have been used are fully acknowledged.



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ABSTRACT

In general, economists agree that monetary policy can affect real economic activities at least in the short run. However, monetary transmission process is still under debate, especially in developing economies. The transition from a central planning economy toward a market base economy is allowing monetary policy to exert a greater role in Vietnam's economy. Thus, understanding the role of monetary policy and its impact on the economy is very important for policymakers.

Key literature on monetary transmission mechanism is reviewed in Chapter 2. The empirical evidence of monetary transmission in developing countries is also analyzed. It is found that the transmission process in economies with a fixed exchange rate regime and dollarization such as Vietnam is still unexplored. Hence, this thesis could contribute to the existing literature by evaluating the impact of monetary policy in Vietnam in the period 1999-2006.

In Chapter 3, a comprehensive analytical review of banking reform, operation of monetary policy and dollarization in Vietnam is carried out. A key conclusion is that reform in banking sector in past years has generate pressure and allowed banks to operate on a more commercial basis and has led State-owned commercial banks to move towards profit maximization. Therefore, the analysis of monetary transmission mechanism in Vietnam can be implemented.

Empirical models for investigating different channels of monetary transmission process are presented in Chapter 4 and Chapter 5. Unlike previous literature on Vietnam, in this study the structural vector autoregression (VAR) models allow a differentiation between domestic monetary aggregate and foreign currency aggregate in the banking system as well as domestic currency interest rate and domestic US dollar interest rate in order to analyze the impact of monetary policy in a dollarized economy. The *non-recursive* VAR model is able to better explain the dynamic response of Vietnam's economy in the case the central bank changes interest rates of domestic currency and US dollar or the supply of domestic monetary aggregate. Results from this model demonstrate that there is no evidence of 'liquidity puzzle' and 'price puzzle', which are often found in previous studies on monetary transmission. The impulse response of domestic currency interest rate after a tightening in domestic US dollar interest rate suggests that the central bank in Vietnam is still able to maintain independent monetary policy. Results from *recursive* VAR model of bank lending channel model also indicate that the bank lending activity in domestic currency and US dollar did enhance the impacts of changes in monetary policy on output and inflation.

The main policy implication of the study is that in the period 1999-2006 the responses of output and inflation after changes in monetary are consistent with theory. The loosening monetary policy that central bank in Vietnam has implemented since 1999 did stimulate output but it also raised inflation and level of dollarization in several years. Therefore, in implementing monetary policy the central bank should not only pay attention to achieve annual targets but also need to consider long-term impacts.

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LIST OF ABBREVIATIONS

BSP	BANK FOR SOCIAL POLICIES
CIEM	CENTRAL INSTITUTE OF ECONOMIC OF MANAGEMENT
DIV	DEPOSIT INSURANCE OF VIETNAM
FCD	FOREIGN CURRENCY DEPOSIT
IMF	INTERNATIONAL MONETARY FUND
MOF	MINISTRY OF FINANCE
STB	STATE BANK OF VIETNAM
SOCB	STATE-OWNED COMMERCIAL BANK
SOE	STATE-OWNED ENTERPRISE
SVAR	STRUCTURAL VECTOR AUTOREGRESSION MODEL
TOR	TURNOVER RATE (OF CENTRAL BANK GOVERNORS)
USD	US DOLLAR
VAR	VECTOR AUTOREGRESSION MODEL
VDB	VIETNAM DEVELOPMENT BANK
VND	VIETNAMESE DONG
WB	WORLD BANK
WTO	WORLD TRADE ORGANISATION

CHAPTER 1 INTRODUCTION

1.1 Introduction

In recent years, there has been a revival of interest in the role played by monetary policy in the economy. Modern economics stresses that monetary policy has a significant influence on economic behavior, at least in the short term. The monetary transmission mechanism can be defined as the process through which monetary policy decisions are transmitted into changes in real GDP and inflation (Taylor 1995). In the literature, there are many empirical studies of monetary transmission for developed countries but not many for developing countries. Even in developed countries, views differ on monetary transmission although it has been the subject of many empirical studies over a long period (Mishkin 1995). The transmission process in developing countries is still more uncertain as different channels of monetary transmission may have different impacts to those in developed economies. These differences may arise from the specific framework of monetary policy as well as the structure of the financial sector in each country.

In Vietnam, since the implementation of the renovation policy in 1986, the economy has been gradually moving towards a market mechanism. As a result, there have been substantial changes in the institutional settings of the financial sector and the implementation of monetary policy. Between 1997 and 2002, the slowdown in foreign direct investment and the contagion effect of the Asian Financial Crisis made Vietnam's economy more dependent on its own monetary policy, and banking system in boosting GDP growth (Kovsted *et al*, 2005). Monetary policy has exerted a greater role in the

economy and the banking system has become more effective in the intermediation of financial resources. However, how important monetary policy is for Vietnam is still under debate. Previous studies, such as Pham and Vo (2005) on monetary transmission between 1999 and 2004 find that the impact of monetary policy seems to be inconsistent with theory. The State Bank of Vietnam (2004) also claims that the increase in inflation does not stem only from the expansionary monetary policy implemented in previous years to promote growth, but also from other factors, for example, the compulsory increases in wages and pensions. However, Baker *et al* (2006) argues that monetary factors appear to have become an important determinant of inflation in recent years because the liberalization in price controls could have increased the responsiveness of domestic prices to changes in monetary policy. Therefore, an empirical study on the monetary transmission mechanism in Vietnam would extend understanding of this process in the context of a developing country and help the State Bank of Vietnam (the central bank) in formulating appropriate monetary policy.

The thesis reviews the existing literature and empirical studies on the monetary transmission mechanism in developing countries, examines the necessary conditions for analyzing this issue in Vietnam, and investigates different structural vector autoregressive models for identifying the monetary transmission process in the case of Vietnam.

1.2 Purpose, scope and contribution of the thesis

Understanding monetary transmission is useful for managing the economy. Firstly, through the monetary transmission mechanism we can know which monetary aggregates (M1, M2, broad money) are impacted by monetary policy. This would help central banks in choosing appropriate targets in their operations. Secondly, a better understanding of the monetary transmission mechanism helps the central bank assess the movements in monetary aggregates more precisely. Both of the above would improve our understanding of the linkage between the financial and real sectors in the economy.

Vietnam is in a transitional process from a central planning economy towards a market based economy. In implementing monetary policy, the central bank in Vietnam has to deal with the dollarisation issue, the pegged exchange rate, and capital control. In the literature, there are only some studies on monetary transmission in transitional and dollarized economies (Kamin *et al* 1998). Therefore, a study on the monetary transmission process in Vietnam would be useful. This thesis addresses the question: 'How effective was monetary policy for economic management in Vietnam in the period 1999-2006?'. The period 1999-2006 is chosen because in that time Vietnam experienced numerous banking reforms. It will be shown that the necessary conditions for the implementation of effective monetary policy were established. The dollarisation issue may also affect the monetary transmission process in Vietnam's economy. Thus, dollarisation also needs to be addressed in the model of monetary transmission. The structural vector autoregressive models are used to analyse the different effects of

monetary transmission process. Then conclusions and recommendations can be drawn for Vietnam in implementing monetary policy.

1.3 Organization of the Thesis

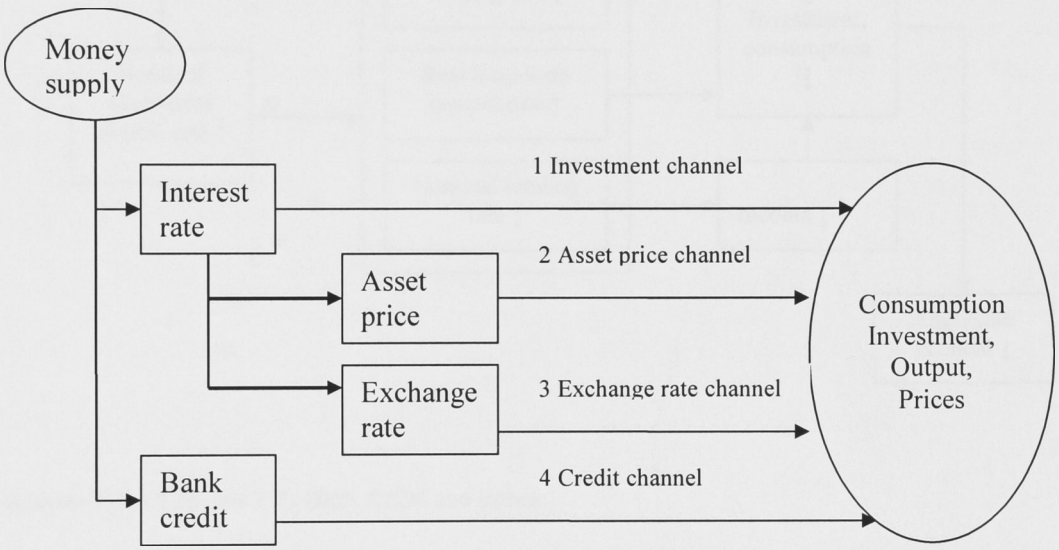
The organization of the thesis is as follows. Chapter 2 is a review of the theories of monetary transmission and the empirical applications to developing countries. Chapter 3 examines the preconditions for the banking sector to operate on a commercial basis in Vietnam during 1999-2006. Specifically, Chapter 3 analyzes the independence of the State Bank of Vietnam in implementing monetary policy, reviews the deregulation process in the banking sector, and discusses the impact of dollarisation on monetary policy. Chapter 4 investigates the impact of monetary policy on Vietnam's economy by employing a *recursive* structural vector autoregression model and then by using a *non-recursive* structural vector autoregression model. In the recursive model the interactions between current values of variables in the vector autoregression model are assumed to be one-way only following the ordering of variables in the model. However, in the non-recursive model the interactions between current values of variables in the model do not depend on the ordering of variables. Chapter 5 uses *recursive* structural vector autoregression model to examine the impact of monetary transmission through bank lending channel. Chapter 6 concludes the findings and offers some policy recommendations.

CHAPTER 2 MONETARY TRANSMISSION MECHANISM - REVIEW OF THE KEY LITERATURE

2.1 Main theoretical hypotheses

Four main hypotheses of transmission of monetary policy have been identified in the literature (Mishkin 1995).

Figure 2.1 **Channels of monetary transmission mechanism**

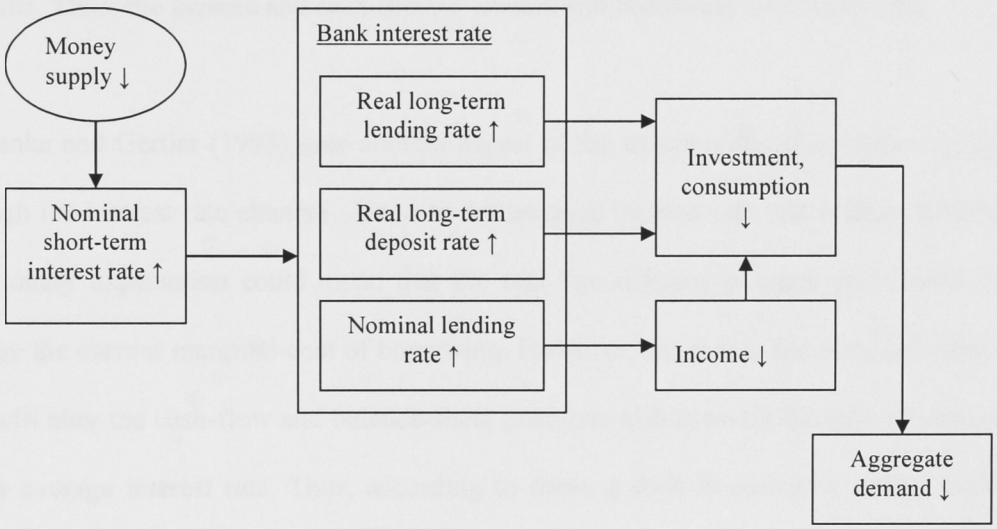


Source: Pham T.H., Vo T.T., 2005, CIEM.

The first is the conventional interest rate channel in the IS-LM framework originally introduced by Keynes in 1930s (Mankiw *et al* 1999) that focuses on direct interest rate effects. In this conventional model of monetary transmission, a shift in monetary policy leads to a change in the money supply. For a given money demand the change in money

supply leads to changes in interest rates in the money market. Changes in bank loan rates would affect investment decisions and changes in deposit rates would affect saving decisions. The transmission of monetary policy through the interest rate channel is summarized in Figure 2.2.

Figure 2.2 **Interest rate channel**



Source: Pham T.H., Vo T.T., 2005, CIEM and author.

A key issue in this hypothesis is how the change in the interest rate most directly under the central bank's control (usually the overnight rate) affects other short-term rates and spreads to long-term rates, which are relevant to investment decisions. This depends on the development of the financial market and the expectation of inflation.

Furthermore, in this framework, the present value of assets is inversely related to the real interest rate. Changes in interest rates not only alter the marginal cost of borrowing but

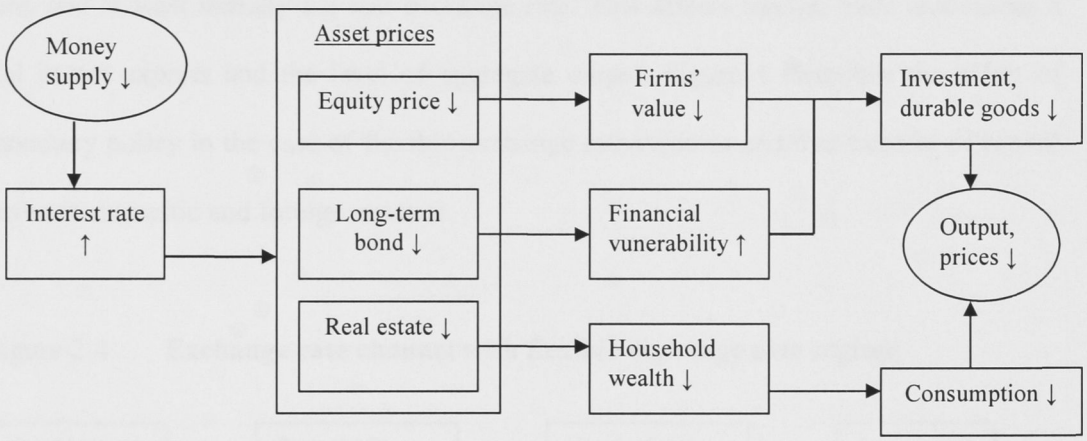
also lead to changes in the average interest rate, which also have cash flow effects on borrowers and lenders. Taylor (1995) argues that the distinction between real and nominal interest rates is important in differentiating between the effects of marginal and average interest rate. He stresses that it is the marginal cost of borrowing that determines saving and investment decisions, and that the marginal cost is affected by the real interest rate. Changes in interest rate also lead to changes to average cost of outstanding loans and deposits. Thus, the income and cash flow of lenders and borrowers will be affected.

Bernanke and Gertler (1995) note another aspect of the transmission of monetary policy through the interest rate channel. A rise in the nominal interest rate that reflects a higher inflationary expectation could mean that the real rate remains constant and would not change the current marginal cost of borrowing. However, the rise in the nominal interest rate will alter the cash-flow and balance-sheet positions of borrowers because of changes in the average interest rate. Thus, according to them, a shift in monetary policy would lead to changes in output and inflation.

The second channel is the impact of monetary policy through changes in asset prices, such as bonds, share and real estate prices, which are described in Figure 2.3. Changes in interest rates affect the prices of assets such as bonds, shares and real estate in the economy. First, the indirect effect of monetary policy on an economy can be transmitted through the life cycle model of consumption developed by Modigliani (1986). In this model, the hypothesis is that consumer spending is determined by their lifetime resources. Modigliani (1986) argues that a rise in nominal interest rates reduces the value

of household assets such as stocks, fixed rate bonds and real estate, thus decreasing household wealth. As a result households revise their income expectations and hence reduce their consumption. Similarly, changes in the value of assets held by firms due to monetary action would alter the firm's investment plan. Changes in consumption and investment lead to changes in output and inflation.

Figure 2.3 **Asset price channel**

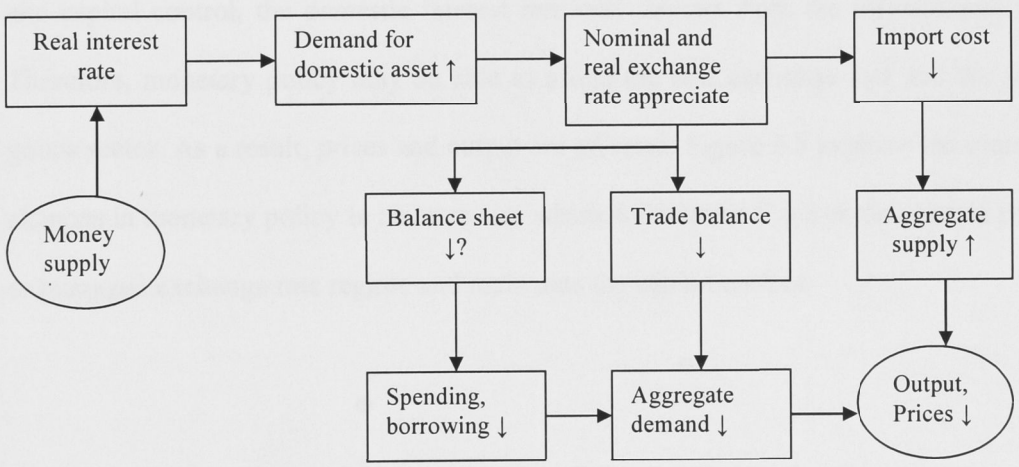


Source: Pham T.H., Vo T.T., 2005, CIEM.

Second, another way that asset price changes induced by monetary policy can affect output is described by Tobin's q theory of investment (Tobin 1969). This suggests that if a central bank loosens its monetary policy, share prices may rise. Thus the market price of firms could be higher than the replacement cost of capital. This will lower the effective cost of capital as the newly issued shares can have a higher price relative to the cost of the real equipment and plant. Therefore, even if the interest rates react little to policy easing, monetary policy can still affect the cost of capital and investment spending.

The third hypothesis is the exchange rate channel, which is closely related to the exchange rate regime and capital control. Taylor (1995) explains that under a flexible exchange rate regime and no capital control, the exchange rate effects involve interest rate effects. This happens when the domestic interest rate rises after monetary tightening and domestic currency deposits become more attractive compared with deposits denominated in foreign currencies. This leads to an appreciation of the nominal exchange rate, and at least initially the real exchange rate. This affects foreign trade and causes a fall in net exports and the level of aggregate output. Figure 4 describes the effect of monetary policy in the case of flexible exchange rate regimes and free transfer of capital between domestic and foreign markets.

Figure 2.4 **Exchange rate channel with flexible exchange rate regime**

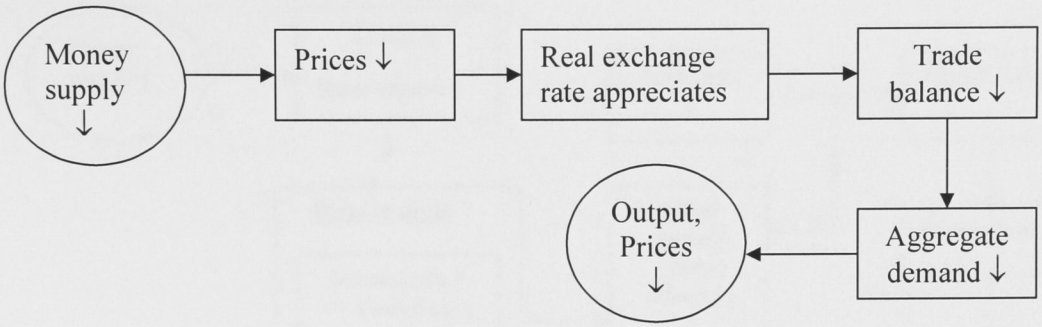


Source: Pham T.H., Vo T.T., 2005, CIEM.

Changes in exchange rates can also affect output and inflation through other processes. First is the exchange rate pass-through effect – changes in the domestic prices resulting from variations in the nominal exchange rate. Second is the balance sheet effect, which may be more relevant to developing countries. Kamin *et al* (1998) indicate that in many developing countries, firms and households have debts denominated in foreign currencies. They also assert that if the debt is not fully offset by foreign currency revenues or is hedged in the foreign exchange market, changes in the exchange rate will affect the net worth of firms and households. This leads to changes in borrowing and spending by these firms and households.

However, Hallwood and Macdonald (2000) maintain that under a fixed exchange rate regime and no capital control, monetary policy does not have any effect on output through the exchange rate channel. On the other hand, under a fixed exchange rate regime and capital control, the domestic interest rate may deviate from the international level. Therefore, monetary policy may be able to affect the real exchange rate and the traded goods sector. As a result, prices and output are affected. Figure 2.5 explains the impact of changes in monetary policy in an economy which follows the fixed exchange rate regime or managed exchange rate regime and maintains the capital control.

Figure 2.5 **Exchange rate channel with fixed or managed exchange rate regime**

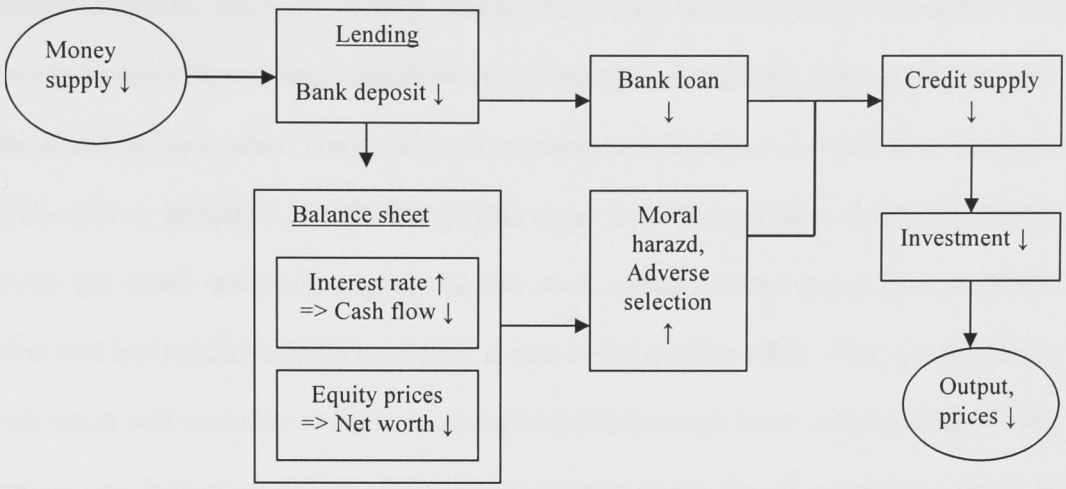


Source: Pham T.H., Vo T.T., 2005, CIEM.

The final hypothesis is the credit channel, which focuses on the role of the banking system in providing credit to the economy. Meltzer (1995) argues that the development of financial markets in recent decades may have reduced the importance of the credit channel. However, Bernanke and Gertler (1995) demonstrate that banks still play an important role in the credit market even in developed countries where financial markets are well developed.

Studies by Kashyap *et al* (1993), on the US, and Kim (1999) on Korea confirm the existence of the credit channel in these developed economies. The credit channel assumes that firms and households depend significantly on external borrowing. This can be divided into the balance sheet channel and the bank lending channel. Figure 2.6 describes transmission of changes in monetary policy to changes in output and prices through the credit channel.

Figure 2.6 **Credit channel**



Source: Pham T.H., Vo T.T., 2005, CIEM.

Bernanke and Blinder (1988) establish that the main assumption underlying the balance sheet channel hypothesis is that the price borrowers pay for their debt depends on their net worth used as collateral. The higher the net worth, the lower the price borrowers have to pay for their borrowing. Furthermore, Bernanke and Gertler (1995) point out that monetary policy may affect the availability of credit through its effects on the value of assets not only of borrowers but also of lenders. First, the value of the collateral for bank loans may be affected by changes in asset prices. Therefore, the access of borrowers to bank credit could be affected. Second, a bank may invest part of its assets in equity or real estate. The decline in asset prices could lower the capital/asset ratio of the bank and pressure it to decrease the supply of credit. Thus, the balance sheet channel explains the distributional effects of monetary policy on both lenders and borrowers while the conventional view does not.

The bank lending channel was first proposed by Roosa (Roosa 1951, cited in Kuttner and Mosser 2002:18). The bank lending channel hypothesis is based on the assumption that there is a class of borrowers, usually small and medium enterprises, who are significantly dependent on bank loans. The problem of asymmetric information is serious for this class of borrowers. Bernanke and Blinder (1988) argue that whereas large firms can directly access the credit market through bond and stock issues without going through banks, small and less reputable firms have poor access to the credit market. Thus, a reduction in bank loans will make the small and medium sized borrowers incur costs associated with finding new lenders or reduce production and employment. Hence, output and prices in the economy are likely to be affected.

Although most of the literature on the credit channel concentrates on investment by firms, Bernanke and Gertler (1995) suggest that it should be applied to household spending as well.

2.2 Empirical evidence of monetary transmission in developing countries

In general, empirical studies on developing countries support the existence of all four hypotheses. However, due to the specific conditions of each country the relative importance of each hypothesis is different. Kamin *et al* (1998) stress that analyzing the different channels of transmission shows that changes in monetary policy affect the real economy in two stages. The first is the transmission from the monetary instrument directly under the central bank's control (money supply, short-term interest rates, and reserve requirements) to financial variables such as: deposit rates, loan rates, exchange rate, and asset prices. The second stage of the transmission process is from those financial variables to spending decisions of households and firms. The structure of the financial system and current conditions in developing countries also play an important role in the transmission process.

2.2.1 Interest rate channel

Kamin *et al* (1998) suggest that most literature on monetary transmission points to the effectiveness of interest rate channel being dependent on the extent and the speed of change in the interest rate directly under the central bank's control (usually the overnight inter-bank rate). This then affects all short-term interest rates. In addition, they agree it is important to note how changes in short-term rates spread to all types of interest rates, in particular the long-term interest rates which are most relevant to investment and spending decisions. According to them six factors influence the interest rate channel.

First is the competitiveness within the banking sector. Kamin *et al* (1998) argue that

monetary policy plays its role effectively when changes in the inter-bank interest rate lead quickly to changes in deposit and lending rates. The responsiveness of deposit and lending rates depends on the degree of competition in the banking sector. When there are many banks and market conditions are competitive, changes in the cost of funds are likely to rapidly affect loan and deposit rates. However, in developing countries, the banking sector is usually concentrated. Thus oligopolistic pricing may occur. Some large banks may determine the interest levels in the market; other smaller banks are under pressure to follow those levels.

An empirical study by Iljas (1998) on Indonesia confirms this practice. Furthermore, the response of loan and deposit rates to changes in the money market may be sluggish and asymmetric. Sirivedhin (1998) and Carrasquilla (1998) both show that banks tend to adjust lending rates less frequently than deposit rates in Thailand and Columbia. Thus, the competition level may be different between the deposit market and the lending market. In addition, Podpiera's (2006) study of China's state-owned commercial banks confirms that in developing countries the presence of state-owned or state-subsidized banks under little pressure to maximize profits could diminish the responsiveness of loan and deposit rates to changes in monetary policy.

Second, the effectiveness of the interest rate channel is related to access to the domestic informal market by firms and households. The interest rates on deposits and loans set by the banking sector may also depend on how firms and households access alternative domestic funding sources. Kamin *et al* (1998) point out that in many developing

countries the informal market plays an important role. They also claim that where the formal banking sector and informal markets are highly segregated, monetary policy only has a limited impact on the informal market. The transmission of monetary policy is more effective when formal and informal markets are integrated to some degree. Rocha (1998) finds that tighter monetary policy, which raises bank deposits, may encourage households to shift their savings from the informal market to the formal market As a result funds available in the informal market are reduced. Thus activity of sectors dependent on informal market credit will be affected. Haughton (2000) finds that (based on data obtained from Vietnam's living standards measurement surveys of 1992-3 and 1997-8) Vietnamese households were also acting as financial intermediaries. These surveys show that about half of the households were borrowers and 14 per cent were lenders. In addition, nearly half of the lenders had borrowed funds at an average rate of 1.3 per cent per month and were lending at an average rate of 2.6 per cent per month.

Third, the development of the capital market has an impact on the interest rate channel. Kamin *et al* (1998) argue that the depth of money and capital markets can also have an important effect on the movement of interest rates. They reason that the capital market provides an alternative source of funds to firms and households besides the banking system. If the capital market is developed, movement in the interest rates in this market and money market rates may closely relate to each other. In contrast, Klein (1998) suggests that a thin or uncompetitive capital market can cause major volatility in the money market interest rates. Banks may not adjust their loan and deposit rates in response to movements in the money market rates if these rates are highly variable. As capital

market in many developing countries remains in the early stages of development, its impact on the credit channel may be limited.

Fourth, the initial financial conditions of firms and households also affect the transmission of monetary policy. Kamin *et al* (1998) observe that in some developing countries where financial intermediation is underdeveloped, investment is usually financed by internal sources (such as personal savings and retained earnings). They claim that the impact of changes in monetary policy on spending and investment decisions may be constrained. For example, investment by firms in India was mostly from internal sources (Kamin *et al,* 1998). However, research on Thailand by Sirivedhin (1998) indicates that in a developing economy where financial intermediation of banks is well established, the financial sector's ability and efficiency to channel savings to borrowers could help to increase the sensitivity of spending and investment decisions by firms and households to changes in monetary policy.

The changes in monetary policy may affect sectors in the economy differently due to the pattern of financing. Kamin *et al* (1998) assert that sectors such as construction or mining, which have high requirements for fixed capital, are likely to be dependent on bank credit. Thus, those sectors are sensitive to monetary conditions.

Fifth, the time-length of financial contracts between borrowers and lenders is a factor that affects the interest rate channel. Bernanke and Gertler (1995) argue that changes in monetary policy could affect economic activity by altering the cash-flow position of

borrowers. They reason that this depends not only on the magnitude to which changes in policy-induced interest rates lead to changes in new deposit and lending rates, but also on how quickly changes in the new rates lead to changes in average rates. Thus the maturity of financial contracts plays a pivotal role here. The shorter the maturity, the more frequently will deposits and loans be renewed at new interest rates. Thus the average rates earned by depositors and paid by borrowers will change quickly. The time-length of the financial contracts may reflect the degree of inflationary expectation in the economy. Thus, the higher the inflationary expectations, the shorter the time-length of financial contracts.

Kamin *et al* (1998) consider that another factor determining the changes in average rates is the use of deposits and loans with adjustable interest rates. The average rates will be changed in response to the adjustment of contractual interest rates. Mohan (2006) suggests that in India the rigidity of interest rates in the market, due to the existence of administered interest rates in certain segment of banking sector, reduces the effectiveness of monetary transmission.

Finally, the access of domestic firms to offshore borrowing also affects monetary transmission through the interest rate channel. Garnaut (1998a) shows external borrowing has become an important source of funds for many developing countries in Asia. This allows firms to reduce their dependence on the domestic credit market and lessens the impact of domestic monetary policy on aggregate demand. As an example, Sirivedhin (1998) finds external financing of Thai enterprises grew from 16 per cent of GDP in 1989

to 27 per cent in 1995.

A monetary tightening that raises domestic lending rates may cause firms to switch to offshore borrowing if the differential between the domestic and foreign interest rates is larger than the expected change in the exchange rate. Thus, the effectiveness of domestic monetary policy is reduced. Carrasquilla (1998) and Sirivedhin (1998) both find that only large firms could access offshore markets in studies on Columbia and Thailand respectively. Therefore the impact of monetary tightening will fall on small firms and households. As a result, the transmission of monetary tightening may become more uncertain because small firms are usually vulnerable to credit rationing and face financial constraints.

Kamin *et al* (1998) conclude that most empirical studies on developing countries find that the interest rate channel is an important channel to transmit money shocks to the economy because of its direct effects on participants in the economy. Frankel (1999) indicates that in countries which adopt a currency board, such as Argentina and Hong Kong, the monetary authority does not have an independent monetary policy. Thus, in this case, the importance of the interest rate channel depends on changes in monetary policy in the anchor currency.

2.2.2 Exchange rate channel

How capital flows are managed is closely related to the transmission of monetary policy through the exchange rate channel. Kamin *et al* (1998) note that the exchange rate

channel plays an important role in the transmission process in developing countries because in those countries the exchange rate could be considered the most important "asset price" affected by monetary policy. In the absence of capital controls, in theory the effectiveness of domestic monetary policy is determined by the exchange rate regime and the degree of substitution between domestic and foreign assets.

Hallwood and Macdonald (2000) explain that in an economy with a fixed exchange rate regime plus domestic and foreign assets being perfect substitutes, any changes in monetary policy could be offset by the fluctuation in capital flows. Thus domestic monetary conditions remain unchanged. In other words, the central bank loses its monetary independence in this case.

Only when capital control is used or the degree of substitution between domestic and foreign assets is limited, does the central bank have more scope to adjust domestic interest rates independently of foreign interest rates. However, the central bank's ability to sterilize the capital flows is pivotal in this case. Warr (1998) shows that the incomplete sterilization by the Bank of Thailand (the central bank) and the liberalization of capital control were major causes of the financial crisis in this country in late 1990. Goodfriend and Prasad (2006) also find that China, with strict capital controls, experienced difficulty in sterilization of capital inflows in order to maintain a fixed exchange rate with the US dollar. Thus, since August 2006, China has gradually allowed the exchange rate to appreciate to control capital inflows. However, McCauley (2006) notes that in Malaysia, although capital controls were porous, they were sufficient to allow Malaysia to have an

independent monetary policy after the Asian Financial Crisis in 1997-8.

Empirical studies on the exchange rate channel can be divided into two areas: open economies with a flexible exchange rate and open economies with a fixed exchange rate (Hallwood and Macdonald 2000). In the latter, the exchange rate channel does not have any role in the transmission process. However, as Warr (1998) indicates, the real exchange rate does have a role in affecting spending and investment decisions in the economy through its effect on the traded goods sector.

The dollarization issue also needs to be considered in analyzing the exchange rate channel. Reinhart *et al* (2003) show that many developing countries have experienced the use of foreign currency in parallel with their domestic currency as a unit of account, a store of value, a means of transaction, or all three. The reason is usually the instability in the economic and political circumstances in those countries. Rennhack and Nozaki (2006) remark that the transmission of monetary policy in a dollarized economy is complex because assets can be denominated in the domestic currency or foreign currency and assets can be local or foreign. Thus the transmission of monetary policy will depend not only on substitution between assets denominated in the domestic currency and foreign currency in the local market but also substitution between assets denominated in the foreign currency in the local and foreign markets. For example, assets in domestic currency and foreign currency in the local market are close substitutes but assets in foreign currency in the local market and foreign market are not close substitutes (due to restrictions on capital flows or on ownership). Assuming the exchange rate is fixed; a

tightening of monetary policy will lead to an increase in interest rates of the domestic currency and may induce borrowers to switch to foreign currency loans in the domestic market. Hence the interest rates of foreign currency loans and deposits increase. Therefore, in this case monetary policy is effective.

However, Kamin *et al* (1998) reason that when foreign currency assets in the local market and foreign market are highly substitutable, the transmission of monetary policy will be similar to that of a non-dollarized economy with no capital control, except that access to foreign currency loans might be more prevalent in a dollarised economy than in a non-dollarized one.

Misaico (2001) and Reinhart *et al* (2003) provide some preliminary results on monetary transmission in dollarized economies. They conclude that the channel of transmission is closely linked to the degree of dollarization, the exchange rate regime and regulations on capital flows in each country.

2.2.3 Asset price channel

Kamin *et al* (1998) suggest that in developing countries where the financial markets for bonds and equities are under-developed, the transmission of monetary policy through the asset price channel is difficult to measure. However, Disyatat and Vongsinsirikul (2003) in an empirical study of Thailand - a country where financial markets are well established - finds evidence of an asset price channel in the transmission process.

2.2.4 Credit channel

Interest rate control is also a factor that should be accounted for when analyzing the credit channel in developing economies. Kamin *et al* (1998) note that the central banks in some developing countries impose limits on deposit and lending rates. The limits placed on interest rates safeguard commercial banks' profitability but reduce competition in the market. Furthermore, these restrictions on interest rates may influence the transmission of monetary policy because commercial banks cannot adjust their rates to balance the demand and supply of credit or to compensate for different levels of risk. Kwok (2006) shows that in China, the central bank has imposed caps on various deposit rates and floors on different lending rates, guaranteeing a large interest rate spread. The cap on the benchmark one-year deposit rate, for instance, is 2.52 per cent, while the floor for the one-year lending rate is slightly over 6 per cent, allowing banks and those institutions that lend money a 3.5 per cent interest spread. Mohan (2006) confirms that administered interest rates are applied to savings in India. Thus, competition between banks is restricted to some extent.

Another factor that affects the credit channel is the existence of bank lending limits. In some developing countries the central banks impose direct targets or exert influence on bank lending. This policy serves many purposes. Kamin *et al* (1998) indicate that in Brazil, a credit ceiling was imposed in 1995 in order to reduce the rapid growth of credit and inflation, whereas in other countries (China, Malaysia and Indonesia) there are lending guidelines to support some privileged sectors. Thus, businesses which do not

belong to the privileged sector may have limited access to bank credit and have to rely more on the informal financial market. McCauley (2006) also shows that limits on the amount of borrowings and levels of interest rates have been applied to the credit card sector in Thailand due to excessive expansion of the credit card market in recent years.

In contrast to the asset price channel, Kamin *et al* (1998) conclude that most empirical studies on developing economies find evidence of the credit channel because businesses are still heavily dependent on the banking system.

In general, empirical studies on the transmission of monetary policy in developing countries show some unresolved issues. Kamin *et al* (1998) argue that the first issue is how the central banks measure the tightness of monetary conditions in developing economies. This relates to whether the central banks follow a monetary targeting policy or interest rate targeting policy. Because many factors affect the channels of transmission in developing economies, the interpretation of monetary stance is difficult.

The second issue is the effect of monetary policy in highly inflationary economies. Lopez (1998) and Eyzaguirre (1998) stress that when inflation is high and unstable, the importance of the different channels may be reduced because the real interest rate becomes unstable, maturity of financial instruments decreases and the degree of dollarization in the economy could increase.

The final unresolved issue is the transmission of monetary policy in economies with a fixed exchange rate regime and dollarization. Reinhart *et al* (2003) stress that many countries have relied on the fixed exchange rate as a less costly way to control inflation. However, this policy may lead to the loss of monetary independence. Since the Asian Financial Crisis, the transmission of monetary policy in developing countries which experienced the crisis has been given more emphasis (Garnaut 1998b). However, the transmission mechanism in countries with a fixed exchange rate regime, capital control and dollarization such as Vietnam is still unexplored. The current research on Vietnam fills this gap in the literature.

CHAPTER 3 BANKING REFORM AND MONETARY POLICY IN VIETNAM

3.1 Independence of the central bank and the monetary transmission mechanism

Central bank independence refers to the freedom of monetary policy makers from direct political or governmental influence in the conduct of policy (Kovsted 2005). Walsh (2003) finds that empirical studies on developed economies using various indices have shown that central bank independence is negatively correlated with the average inflation rates but has no correlation with GDP growth. However, there are different levels of central bank independence even in developed economies. Although there are some questions on the causality of these correlations, these findings have encouraged developing countries which have experienced high inflation, to reform their central banks in order to achieve better price stability. Sturm and de Haan (2001) conclude that although empirical results on the relationship between central bank independence and inflation in developing countries are mixed, it is widely believed that a high level of central bank independence and an explicit mandate for the central bank to restrain inflation are important institutional devices to maintain price stability. The control of inflation is usually one of the major objectives of monetary policy in most countries. Central bank independence enhances the credibility of it's commitment to price stability. McDonough (2002) indicates that the credibility of a central bank's commitment to price stability is also important because a credible central bank may be more effective in conducting stabilization policy. He argues that a stimulative monetary policy in response to a slowdown in aggregate demand would be less likely to undermine a central bank's commitment to price stability when the central bank is independent. Thus the

effectiveness of the monetary transmission mechanism is partly related to the independence of the central bank.

Since the late 1980s Vietnam's economy had gradually shifted to a market-oriented one and at the same time, many steps were taken towards reforming the Vietnamese banking sector. In 1988 Decree No.53/ND was issued to establish the state-owned, specialized commercial banks that were separate from the State Bank of Vietnam (SBV). This decree was the first step toward transforming the one-tier banking system into a two-tier system. In 1990 the issuance of two Ordinances on banking (the 'Ordinance of the State Bank of Vietnam' and the 'Ordinance on Banks, Credit Cooperatives and Finance Companies') confirmed the transformation into a two-tier banking system. For the first time the objectives, duties and operational purposes of each tier of the banking system were stipulated. The State Bank of Vietnam was officially authorized to assume the traditional functions of a central bank such as the conduct of monetary policy and supervision of the financial system.

In 1998 the role of the SBV was enhanced by the Law on the State Bank of Vietnam. Unlike some other developing countries (Thailand for example) where the central banks could operate at their discretion and be independent of the government, the Law on the SBV stipulates that the SBV is a body which belongs to the government. According to the Law on the SBV the conduct of monetary policy in Vietnam can be summarized as follows. First, every year the SBV submits a proposal for monetary policy to the government. The government may then submit a modified proposal for monetary policy

to the National Assembly for discussion and approval. Based on the targets the National Assembly has approved on the GDP growth rate, inflation rate, the amount of new money issuance, credit growth and so on, the government and the SBV are allowed to operate in order to achieve those targets. Thus, the SBV is not the only one to make decisions concerning monetary policy. This raises the issue of the comparison between the independence of the SBV and central banks in some other developing countries.

To evaluate the different aspects of the SBV's independence, Kovsted *et al* (2005) following Cukierman (1992) identify three aspects: (i) legal independence; (ii) political independence and (iii) operational independence. Legal independence is defined as the degree of independence stipulated in the laws about the SBV. They find that the level of legal independence of the SBV, although lower than that of OECD countries, is on par with or exceeds that observed in the region and other developing countries.

Kovsted *et al* (2005) define political independence as the assessment of actual practice of the laws on the SBV under the influences of external factors. Cukierman (1992) proposes using the turnover rate (TOR) of central bank governors, which is the average number of changes of central bank governors per year, as a proxy for central bank political independence. He argued that a higher turnover rate of central bank governors may indicate a lower level of central bank political independence. Table 3.1 shows the results of Kovsted *et al*'s (2005) comparison of political independence between central banks in Vietnam and some other developing countries in the region.

Table 3.1 **Turnover rate of central bank governors, 1980-98** (annual average)

	Indonesia	Korea	Malaysia	Singapore	Thailand	Vietnam
1980-89	0.20	0.40	0.20	0.30	0.10	0.33
1990-98	0.25	0.50	0.25	0.25	0.75	0.50

Source: Kovsted et al, 2005, *From Monobank to Commercial Banking*, NIAS

They conclude that the level of political independence of the SBV has fallen over the two periods and is low in comparison with some other countries in the region. However, their calculation seems to be incorrect for the period 1990-8. In this period the TOR of central bank governors in Vietnam was 0.33 not 0.50. Therefore, the level of political independence did not fall in the period 1990-8 in comparison with period the 1980-9 as Kovsted *et al* (2005) concluded.

In fact the TOR of central bank governors in Vietnam since 1990, when the SBV was established as a central bank, is similar to other countries in the region. Table 3.2 shows the TOR of central bank governors for Vietnam and some selected countries in the period 1990-2005. It can be seen that in this period the level of political independence of the SBV as measured by the TOR of central bank governors is on a par with that of central banks in other countries in the region.

Table 3.2 **Turnover rate of central bank governors, 1990-2005** (annual average)

Period	Philippines	Malaysia	Singapore	Thailand	Vietnam
1990-2005	0.25	0.25	0.19	0.38	0.25

Source: Author's calculations.

Operational independence is defined by Kovsted *et al* (2005) as the ability of the central bank's staff to design and implement policies and strategies. In assessing operational independence, they argued that the SBV appears to be restricted by an overstaffing structure and limited capability of internal training institutions. However, those assessments need to be treated with caution for several reasons. First, as Vietnam is a cash-based economy, a large ratio of staff at the SBV is needed to print and distribute the currency. Second, the quantity and quality of the SBV staff are also enriched by universities outside the SBV which provide better services than the SBV's internal training institutions (WB 2002). Besides, the SBV implemented several technical assistance projects for capacity building with World Bank, IMF, ADB. The increasing usage of open market operations since 2002 suggests that operational capability of the SBV has been improved (SBV 2005). Kovsted *et al* (2005) argue that the SBV cannot effectively develop and execute national monetary policies. However, it should be noted that their conclusion is based on analyzing Vietnam's banking sector before 2002. Thus, considering new evidence on political independence as measured by TOR of governor in period 1990 - 2005 and operational independence of the SBV, it could be said that SBV independence has been equal to other countries in the region in recent years. Hence, it is possible to analyze the effectiveness of the monetary transmission mechanism in Vietnam on a similar basis to other countries.

Furthermore, Goodman (1991) and Posen (1994) argue that developing countries could opt for an indirect approach to obtain central bank independence by developing private banks rather than the direct approach of creating a legally and politically independent

central bank. They propose that developing countries could create and strengthen a domestic constituency for low inflation. Private banks, due to their maturity mismatch of assets and liabilities and the non-marketable nature of their assets, are vulnerable to high inflation. Thus, private banks would support monetary policy that focuses on an objective of low inflation. Thus Goodman (1991) and Posen (1994) reason that the establishment of private banks will lead to a more independent central bank through higher outside pressure for low inflation. It seems that Vietnam has followed this approach. In Vietnam private banks group could consist of all other banks and credit institutions besides the state-owned commercial banks (SOCBs). Table 3 shows the structure of the banking sector in the period 1994-2006.

Table 3.3 **Structure of credit institutions in Vietnam**

	1994	2001	2006
SOCBs		6	6
Joint-stock banks[1]	46	45	35
Joint-venture banks	3	4	6
Foreign bank branches	9	26	37
Financial companies	2	2	7
People Credit Funds	219	na	905

Source: Author's calculations (Vo *et al,* 2002, *An assessment of the risks associated with Vietnam's balance of payments*, Thailand Development Research Institute and data provided by the SBV web site).

[1] Joint-stock banks are banks owned by a group of individuals, enterprises and organisations (They could also called private banks). Total foreign ownership in a joint-stock bank is allowed at maximum of 30 per cent of its chartered capital.

Financial liberalization in this period has made the banking sector more diverse. The number of foreign bank branches has increased noticeably. The number of joint-stock banks has decreased due to the closure and merger of some insolvent banks in this period (NIAS 2002). However, in terms of banking assets, the share of private banks has increased from 10 per cent in 1996 to nearly 22 per cent in 2006 and the share of SOCBs decreased from nearly 80 per cent to 68 per cent in the same period (SBV 2006). The share of SOCBs in the credit market has been reduced from nearly 82 per cent in 1998 to 63.5 per cent in 2006[2]. With implementation of the US-Vietnam bilateral trade agreement and Vietnam's recent WTO membership, it is likely that private banks with foreign capital could play a larger role in the Vietnamese economy. The current relatively high levels of inflation imply that anti-inflation, as suggested by Posen (1994), is likely to become a concern for private banks. The growing private bank sector would generate pressure on the SBV to maintain a low inflation objective.

In conclusion, although the independence of the SBV may not be comparable with the situation in developed countries, it is arguably similar to other developing countries in the region. Thus, the SBV plays an important role in Vietnam's economy. Therefore, analysis of the monetary transmission mechanism is useful in assessing how the SBV implements monetary policy to achieve goals in relation to output and inflation.

[2] Author's calculations.

3.2 Objectives, targets and strategies of monetary policy in Vietnam

The SBV, as a body belonging to the government, is responsible for executing the annual monetary policy approved by National Assembly. The objectives of monetary policy are generally defined as follows: to support the economic growth, to contain inflation and to enhance the purchasing power of the Vietnamese dong (SBV 2005). However, Camen (2006) argues that the ultimate target for government and the SBV is the target for economic growth. Information on targets[3] and solutions of monetary policy are presented in the Annual Reports, Circulars of the Governor of SBV and sometimes media interviews[4]. Generally the monetary policy of the SBV consists of following targets:

First is the target for the growth rate of total liquidity. Total liquidity consists of cash and deposits in Vietnamese dong plus foreign currency deposits[5]. For the same target of total liquidity there would be several combinations of Vietnam dong monetary aggregate and foreign currency deposits. The growth rate of total liquidity might not properly reflect the stance of monetary policy in Vietnam's economy. For example, the increase of US dollar deposits in banking system induced by higher US dollar interest rate could mean higher growth rate of total liquidity but it does not mean that the SBV is implementing a monetary easing. Thus, achieving the target on growth rate of total liquidity should be assessed with caution.

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[3] Target for new money issuance is not released to the public.

[4] For example, in November 2004 the Governor of SBV presented directions of monetary policy on credit growth, exchange rate and interest rate policies for the year 2005 in an interview with Vietnam Economic Times (VET 2004).

[5] There is no data on the volume of foreign currencies in circulation in the form of cash.

Second is the target for growth rate of credit in the economy, which consists of credit in Vietnamese dong and in foreign currencies. The SBV pays close attention to the growth rate and the quality of credit activity because of its relation with economic growth target and the stability of the banking system (SBV 2004).

Third are targets for exchange rate and interest rates. The exchange rate of Vietnamese dong with respect to US dollar is under the management of the SBV and the target for Vietnamese dong/US dollar exchange rate depreciation of approximately 1 per cent per year has been archived in recent years (SBV 2005). Furthermore, the SBV also in some cases indicates its intention with respect to interest rate target. For example, the Governor of SBV states that the target for Vietnamese dong interest rate in 2005 is the same level of 2004 (Nguyen 2004).

In conclusion, the SBV has established targets for its monetary policy and strategies to achieve those targets. However, as the targets are defined annually, the predictability of monetary policy in the long term is limited. As changes in monetary policy usually have impacts over a long horizon, it might be necessary to establish long-term targets for the SBV.

3.3 Banking reform in Vietnam

Research on the monetary transmission mechanism in Vietnam could provide useful results if two more questions are answered: whether the banking regulatory and institutional framework in Vietnam has been improved to encourage banks to operate on commercial terms; and whether the state owned-commercial banks (SOCBs) in Vietnam are moving towards being profit maximizing concerns.

On the institutional side, there have been some notable and positive developments in recent years. First, in July 2000 the Deposit Insurance of Vietnam (DIV) was established as a separate legal entity to the SBV by the Prime Minister[6]. Deposit insurance is compulsory for all state-owned commercial banks, joint-stock banks, foreign bank branches, financial companies and people's credit funds in Vietnam regarding personal deposits. These institutions are required to pay a fixed premium ratio of 0.15 per cent per annum of average balance of personal deposits to the DIV[7]. For an individual's deposits in one bank, the insurance covers up to a maximum of 30 million Vietnamese dongs. At the start, deposits made by private enterprises were not covered by the current deposit insurance scheme. However, in 2005 deposits made by cooperative team, private enterprises and partnerships are allowed to be covered by the insurance. Furthermore, the maximum insurance payable to a depositor was raised to 50 million Vietnamese dongs. Currently, foreign currency deposits are not covered by the deposit insurance. The DIV

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[6] The Deposit Insurance of Vietnam was established pursuant to the Decision No.218/1999/QD-TTg dated Nov 9th 1999 and Decision No.75/2000/QD-TTg dated June 28th 2000.

[7] The DIV are currently studying to change from fixed premium ratio to risk-based premium mechanism (DIV 2006).

also offer special loan to insured institutions which are at risk of insolvency[8]. Kovsted *et al* (2005) argue that the implementation of a deposit insurance scheme is likely to improve public trust in the financial sector.

Second, in 1999 the Credit Information Centre under the control of the SBV was established (Decision No.68/1999/QD-NHNN9). This centre is authorized to collect, analyze and provide information on enterprises and credit institutions. Since 2002 the Credit Information Centre has started to carry out the classification of borrowers according to their repayment capabilities. The operation of the Credit Information Centre is a useful source for the SBV to monitor the situation in the financial markets and for commercial banks to assess credit worthiness of their customers.

In addition, the Vietnamese government established a Registry Centre for Secured Transactions in 2002. The main objective of this centre is to resolve conflicting creditor claims on moveable assets (except ships and planes). This centre could improve overall transparency in the credit market and provide protection to banks in their lending operations (Kovsted *et al* 2002).

Furthermore, in October 2002 the State-owned Bank for Social Policies (BSP) was established operating on non-profit principles (Decision 131/2002/QD-TTg). The policy-lending programs from all other SOCBs have been transferred to the BSP. Thus, the operations of all SOCBs except the BSP are supposed to have been on commercial terms since 2003.

[8] Decision No.106/2002/QD-HDQT of the Board of Directors of the DIV dated June 24th 2002.

In addition to the positive developments on the institutional side, there have been developments on the regulatory side. The SBV has allowed further deregulation of interest rates. The process of deregulating interest rates began in 1996 when commercial banks were allowed to set interest rates on domestic currency deposits. In 1998 the required spread between average deposit and lending interest rates of 0.35 per cent per month imposed by the SBV on commercial banks was abolished. In June 1999 three types of ceilings on lending rates (for short-term, medium and long-term loans and loans provided by Credit Funds to their members) were replaced by one ceiling rate of 1.15 per cent per month. In August 2000 a new base rate mechanism was introduced to replace the ceiling rate (Decision No.241 and 243/2000/QD-NHNN). The SBV stipulates a base rate based on the lending interest rates that nine selected commercial banks apply to their best customers. Credit institutions which include commercial banks are allowed to set their own lending rates within a trading band of 0.3 per cent for short-term loans and 0.5 per cent for medium and long-term loans in relation to the announced base rate. In June 2002, the trading band in relation to the base rate is abolished. Commercial banks were allowed to negotiate lending rates with customers based on their assessment of risk of each loan (Decision 546/2002/QD-NHNN). Thus, the lending rate on domestic currency was liberalized.

In 1991 the SBV allowed the commercial banks to take deposits in foreign currency (Decision 08-NH/QD). Interest rates on personal foreign currency deposits were deregulated in 1999. In August 2000, the SBV permitted credit institutions to set their own lending rates in foreign currencies within a band of 1-2.5 per cent of the Singapore

Inter-bank market rates. In June 2001 interest rate ceilings on foreign currency loans were abolished. However, due to capital control, interest rates on foreign currency deposits and foreign currency loans still differ from international rates. Finally in March 2007, the interest rate applied to foreign currency deposits made by enterprises and government institutions was deregulated (Decision No.07/2007/QD-NHNN). However, the effect of this last step in interest rate deregulation in financial markets might be limited because a large share of foreign currency deposits in the banking system are in personal savings and interest rates applied to personal savings have already been deregulated since 1999.

These steps should allow banks greater autonomy in their operations and to price risks better. Although interest rates have been gradually deregulated, the SBV does not encourage commercial banks to compete with each other using only interest rates (Son 2004). Thus, except for the foreign bank branches, the four largest SOCBs and joint-stock banks from time to time have arrangements to keep their deposit and lending rates on the Vietnam dong within certain levels. However, those arrangements cannot be kept for long as each SOCB has to protect its own market share against not only the other SOCBs but also the joint-stock banks and foreign banks. Thus, interest rates are generally moved due to the competition between banks and the balance of demand and supply in the market. The round of interest rate rises in 2005, which the SOCBs started, provides an example (Phuong 2005).[9]

[9] The arrangements of interest rates are negotiated by SOCBs and joint-stock banks in Vietnam's Banker Association (VBA) forum. In March and early April 2005 two SOCBs: Vietindebank and Vietcombank raised interest rates first, other banks then followed. On 8 April 2005 VBA announced the new levels for taking VND deposits that SOCBs and joint-stock banks should follow in order to stabilize the money market. For example, the joint-stock banks should offer interest rates higher than the SOCBs level but no

As interest rates were being deregulated, competition in the banking sector has led to a decline in the interest margin in all SOCBs. Unteroberdoerster (2004) shows that the interest rate margin for the domestic currency at the four largest SOCBs has fallen steadily from 7 per cent in the first quarter of 2000 to approximately 3 per cent in the third quarter in 2003. However, the declining interest margin could be a problem for the SOCBs if risk provisioning is not adequate, because the interest rate margin is supposed to cover only service costs, not capital costs.

The implementation of the Bilateral Trade Agreement with the US in the banking sector in 2002 has allowed US banks to expand their operations in Vietnam (WB 2004). Furthermore, since April 2004 and from February 2005[10], EU banks have been granted similar treatment to the US banks. These developments should create a more level playing field and make the market more competitive.

Another improvement in banking regulation is in foreign exchange control. The foreign exchange surrender requirement, which had been applied at the time of the Asian Financial Crisis in 1997-8, was gradually reduced and finally terminated in April 2003. Furthermore, many more foreign exchange instruments have been gradually allowed to trade in the market to satisfy the needs of enterprises and residents (SBV 2005). Thus, these developments should help banks and firms to operate on commercial terms in the

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more than 0.5 per cent per annum higher. However, banks did not follow these arrangements. In August 2008, the VBA organized new negotiation and proposed new round of interest rate rises.

[10] Decision 327/2004/QD-NHNN dated 01/04/2004 and Decision 210/2005/QD-NHNN dated 28/02/2005 on adjustment of mobilizing ratio in Vietnam dong for European Union foreign bank branches.

foreign exchange market.

Unteroberdoerster *et al* (2003) argue that, the reform of SOCBs in Vietnam is closely linked with reform of state-owned enterprises (SOEs) because SOEs are the main recipients of credit from SOCBs. The inefficiency in the SOE sector could create a large ratio of non-performing loans or bad debts for the banking sector, especially for the SOCBs. Table 3.4 shows the decline in the proportion of SOCBs' total credit as well as overall bank credit to SOEs in the period 1998-2006. This means the banking system and SOCBs in particular have become less exposed to SOEs.

Table 3.4 **Credit to state-owned enterprises from the banking system, 1998-2006**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total credit to the economy (Trillion VND)	72.5	112.7	155.7	189	231	296	420	533	693
Credit to SOEs (Trillion VND)	38.1	54.3	69.9	79.7	89.5	105.4	142.9	181.3	218.5
Credit to SOEs as percentage of total credit to the economy (%)	*52.5*	*48.1*	*44.9*	*42.2*	*38.7*	*35.5*	*34*	*32.8*	*31.5*
Total credit extended by SOCBs (Trillion VND)	59	76.5	114.1	136	175.4	214.8	315.3	381.4	440
SOCBs credit to SOEs (Trillion VND)	34.2	na	61.3	72.9	81.6	95.7	145.8	158	175
Credit to SOEs as percentage of total credit extended by SOCBs (%)	*58*	*na*	*53.7*	*53.6*	*46.5*	*44.5*	*46.2*	*41.4*	*39.7*
Credit to other sector as percentage of total credit extended by SOCBs (%)	*42*	*na*	*46.3*	*46.4*	*53.5*	*55.5*	*53.8*	*58.6*	*60.3*

Source: Author's calculations.

There are two reasons for this. First, in 2000 the new Enterprise Law was enacted. This

Law facilitates the establishment of private firms in Vietnam. Vo *et al* (2002) note that in only two years (2000-2001) the number of new private enterprises established under the new Law was higher than the total number of private enterprises established during the period 1991-9. It is arguable that the bank credit market has become more competitive because more private enterprises operate in the market as the stock exchange is an option for only a limited number of firms. Thus, the SOCBs have an opportunity to expand their credit to the private sector in order to maximize their profit and to compete with private banks. Table 3.4 shows that the ratio of total credit from SOCBs to private enterprises has increased from approximately 40 per cent in 1998 to nearly 60 per cent in 2006.

Second, the reform of SOEs in recent years has reduced their number from 6,000 in 1997 to around 4,000 in mid 2004 (WB 2004). Thus, nearly 2,000 SOEs have been liquidated, sold or equitised. Furthermore, in 2004 the Prime Minister issued Decision 155/2004/QD-TTg to limit the number of sectors considered strategic (not to be equitised), which has paved the way for equitization in economic activities which have previously been reserved for the state. This means the number of SOEs receiving credit from SOCBs could be reduced further.

Since 2000 the banking system in general and SOCBs in particular were being restructured with the assistance of the World Bank, ADB and IMF. The restructuring of SOCBs focused on addressing the problem of non-performing loans. According to the SBV, the ratio of non-performing loans reached 11.4 per cent of total outstanding loan volume, 10.8 per cent in SOCBs and 12.4 per cent in joint-stock banks (Kovsted *et al*

2005). However, estimates by IMF using diagnostic audits based on international accounting standards suggested that the ratio of non-performing loans in SOCBs could be much higher (Kovsted *et al* 2005). Gradual implementation of international accounting and auditing standards was one aspect of the restructuring process to ensure the transparency in SOCB operations.

The SBV has made an important improvement in the process of changing Vietnamese accounting standards in accordance with international accounting standards. In November 2000, Decision 488 by the SBV required commercial banks to make provision for their risky loans based on overdue debt. This decision also required that assets should be classified according to assessed risk. Furthermore, the regulation on provisioning was strengthened in Decision 1627 in December 2001. First, it stipulated that the entire loan balance should be classified as overdue debt if any interest and/or principal was overdue. Second, the provisioning should be based on the estimated risk level when the loan is taken up. Third, banks could use risk-provisioning funds to compensate for losses from unforeseen circumstances such as natural disasters.

However, Unteroberdoerster *et al* (2003) noted that the implementation of the new loan classification in some SOCBs remains non-transparent. Thus, Decision 493 in April 2005 by the SBV requested commercial banks[11] to classify their loans into five types and to make provision for each type of loan according to a stipulated ratio. The riskier of the

[11] Foreign bank branches are allowed to classify loans and make provision according to their Head Office regulations but they need the approval of the SBV (Clause 1 Decision 493/2005/QD-NHNN dated April 22nd 2005).

loan, the higher is the ratio of provision applied that debt. The objective of a stricter accounting standard is to regulate the banking sector through the capital adequacy ratio (CAR). At the end of 2004, the capital adequacy ratios in all SOCBs were around 5.6 per cent (SBV 2005). Although SOCBs have received about 10 trillion Vietnamese dongs in capital injections from the government, SOCBs in Vietnam have not reached the capital adequacy ratio of 8 per cent stipulated in the Basel II Accord. However, stringent CAR regulations could lead to a decline in bank lending and affect monetary transmission process if banks are poorly capitalized (Tanaka 2002). Therefore the SBV in April 2005 required all SOCBs to achieve the CAR of 8 per cent in three years and the increase in each year is equal to one third of the differential between the existing ratio and the Basel convention.[12] That means SOCBs are gradually following international standards in their operations. Decision 121 in January 2005 by the SBV allowed a greater role for the independent auditor in the banking sector and paved the way for the use of foreign auditors by SOCBs. This is an important step in the process of listing one of the largest SOCBs (Bank for Foreign Trade of Vietnam) on the stock market[13]. The equitization process could lead to more efficiency and greater transparency in SOCBs' operation.

Another aspect of restructuring of SOCBs is on technical issues. Vietnam's Law on Credit Institutions allows banks to carry on secured and unsecured lending to all types of borrowers depending on the banks' own assessment of risk. However, the SOCBs lack skill and expertise in assessing risk, especially in lending to the private sector (CIEM 2002). With assistance from international financial institutions, SOCBs have carried on

[12] Decision 457/2005/QD-NHNN by State Bank of Vietnam dated 19 April 2005.

[13] The Bank for Foreign Trade of Vietnam is partially equitizied in December 2007 (VET 2007).

restructuring programs. In regard to credit operations, all SOCBs have constructed and implemented new lending management procedures and credit handbooks in accordance with international practice since 2004 (SBV 2005). Relating to organizational restructuring, the World Bank has helped SOCBs to implement the Asset-Liability management, internal audit and management information system modules. Thus, much progress is being made in the technical aspects of banking reforms. With reform in the institutional and regulatory framework, the SOCBs have achieved some improvements in their operation. By the end of 2005, the non-performing loans in the banking system had been reduced to 4.4 per cent according to Vietnam accounting standards of loan classification in Decision 493 (Tran 2006).

Furthermore, there were some major developments in the financial sector in the period 1999-2006. First, foreign insurance firms were allowed to set up 100 per cent owned branches in 1999 in life insurance. The opening of the insurance market was further expanded by the Vietnam-US Bilateral Trade Agreement. This agreement required that entry to all types of insurance would be permitted for US majority-owned and US-owned companies after three and five years, respectively (Kovsted *et al* 2005). Second, the Stock Exchange opened in July 2000. Initially the stock market was not a major source of funding for companies (Kovsted *et al* 2005). In recent years the number of firms and the value of stocks and bonds listed in the Stock Exchange have increased rapidly. At the end of 2006 the market value of stock market was equivalent to 17 per cent of Vietnam's GDP (Tu 2007). The rapid growth of stock market has raised concern to the government. In order to limit the fall-out on banking system from a possible stock "bubble" the

government and the SBV[14] has carried out several prudential measures (Lee *et al* 2007). As a result, the stock market has slowdown in second half of 2007.

In conclusion, reform in the banking sector in past years in Vietnam has generated pressure and allowed banks to operate on a more commercial basis and has led SOCBs to move towards profit maximization, especially since 2000.

[14] Decision 03/2007/QD-NHNN dated January 19th 2007 on new regulations on bank capital adequacy, liquidity ratios, and lending and investment limits, which have restricted scope on bank lending for purchase of stocks. Directive 03 by the SBV dated May 28th 2007 limits banks' total securities-related credit to less than 3 per cent of their total loan outstanding.

3.4 Development of monetary policy instruments

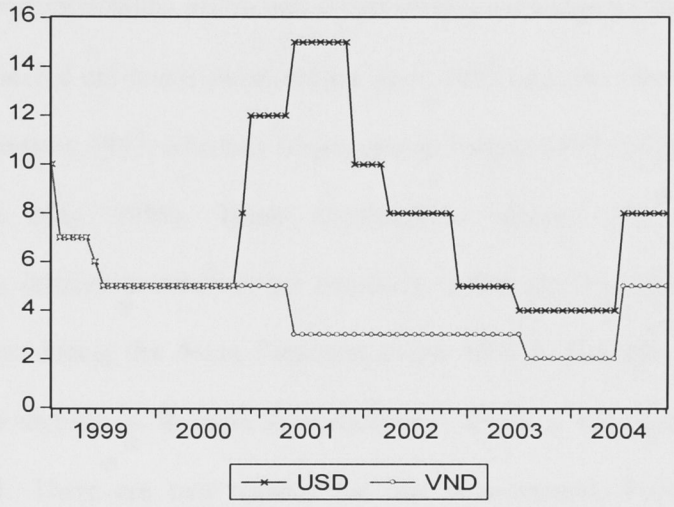
In implementing monetary policy, the SBV has used both direct and indirect instruments. Because the financial market in Vietnam is underdeveloped, direct instruments are more effective and more frequently used (IMF 2005). There have been some major developments in how the SBV has used these instruments in the period 1999-2006.

First, the required reserve is the main instrument for the SBV in implementing monetary policy changes in Vietnam. The SBV imposes minimum levels of reserves on commercial banks for both domestic currency deposits and foreign currency deposits. There different reserve ratios in Vietnamese dong (VND) deposits are required for different type of banks[15]. Lower ratios are usually applied to the Bank for Social Policies, small credit funds and the Bank for Agriculture and Rural Development as a subsidy to the poor because those credit institutions usually operate in rural and mountainous areas. In the period 1999-2006, bank reserve requirement ratios were adjusted downwards for VND deposits and upwards for foreign currency deposits to implement an expansionary monetary policy on the one hand, and to keep dollarization levels in check on the other. Figure 3.1 shows the required reserve ratios applied to most of the banks with regard to the deposits in Vietnamese dong and in foreign currency deposits with terms less than 12 months. Between 1999 and 2003 the SBV reduced substantially the required reserve ratio

[15] Decision 796/NHNN-2004 in June 2004 on required reserve of Vietnamese dong deposits of less than 12 months stated that: the ratio applied to SOCBs (except the Bank for Agriculture and Rural Development), foreign bank branches, urban joint-stock banks, joint-venture banks, financial companies and leasing companies is 5 per cent; the ratio applied to Bank for Agriculture and Rural Development is 4 per cent, the ratio applied to rural joint-stock banks, credit cooperatives and Credit Funds is 2 percent ; and the ratio applied to Bank for Social Policy is zero.

for Vietnamese dong to implement an expansionary monetary policy. However, since 2004, the required reserve ratio has been increased.

Figure 3.1 **Required reserve ratios for Vietnamese dong and foreign currency deposits, 1999-2004.**[16]



Note: The vertical axis is in per cent

Source: Author's calculations.

The second instrument is the exchange rate. In general, the exchange rate is one of the economy's external policies and not an instrument of monetary policy. However, in Vietnam, the exchange rate is considered a monetary policy instrument because it is directly under the control of the SBV. First, capital control could permit the SBV to monitor the official and private flows of foreign exchange through the banking system. There are regulations on behalf of Vietnamese government and the SBV on measures of

[16] New required reserve ratios applied in May 2007 are 10 per cent with both Vietnamese dong and foreign currencies deposits.

foreign exchange managements for residents[17], enterprises[18] and foreign indirect investment[19]. Second, by requiring SOCBs to satisfy the foreign exchange demands according to certain stated priorities and by implementing the foreign exchange surrender rule, the SBV could maintain the official fixed exchange rate for a certain period. Third, in order to monitor the foreign exchange market, the SBV requires banks to submit daily reports on the trading volume, prices and actual foreign exchange position of each bank[20]. The SBV has carried out major devaluations since 1997 (a 6 per cent devaluation to the US dollar in February 1997, a further 10 per cent in August 1997 and another 10 per cent devaluation in May 1998). These devaluations allowed Vietnam to maintain competitiveness relative to other Asian countries which also had substantial exchange rate devaluations during the Asian Financial Crisis 1997-8. However, the devaluations brought about a significant increase in dollarisation levels in the banking system in the period 2000-01. There are two reasons for that phenomenon. First, individuals and

[17] Prime Minister's Decision No.170/1999/QD-TTg dated 19/08/1999 and SBV's Circular 02/2000/QD-NHNN7 dated 24/02/2000 on regulations on receiving and using inward foreign exchange remittance by Vietnamese residents. SBV's Decision 1437/QD-NHNN dated 19/11/2001 on regulations on purposes, limits and procedures for buying and outward remitting of foreign exchange by Vietnamese residents.

[18] SBV's Circular 3/1999/TT-NHNN7 in August 1999 on conditions for enterprises to borrow offshore and SBV's Decision 26/2000/QD-NHNN7 in January 2000 on planning and executing annual limits of offshore borrowings by enterprises. SBV's Circular 01/2001/TT-NHNN dated 19/01/2001 on foreign exchange regulations regarding foreign direct investment by Vietnam's domestic enterprises.

[19] SBV's Decision 998/2002/QD-NHNN dated 13/09/2002 on foreign exchange regulations regarding the trading of foreign resident and foreign organisation in the Stock exchange. The foreign indirect investment reaches US dollar 1 billion in 2006, equivalent of approximately 1.4 per cent of Vietnam's GDP (Ha 2007).

[20] The daily report on foreign exchange activity was abolished on January 2006 by the SBV in Decision 07/2006/QD-NHNN because the modernization of banking payment and information systems has allowed the commercial banks to monitor their foreign exchange positions on a daily basis (SBV 2006).

enterprises changed their holdings from domestic currency deposits to US dollar deposits to maintain the value of their assets in case of further devaluation. Second, the interest rate of Vietnamese dong was on a downward trend and the interest rate of US dollars was on upward trend in this period. Thus, by keeping US dollar deposits, individuals and enterprises could gain from any future devaluation and increased interest rate of US dollar deposits.

Before 1999 the SBV set and announced the levels of official exchange rates between the Vietnamese dong (VND) and US dollar (USD) and the trading band within which commercial banks could trade foreign exchange. In February 1999, the official exchange rate was replaced by an average interbank exchange rate of USD/VND determined and announced by the SBV. In February 1999 the trading band for USD/VND exchange rate was set at 0.1 per cent of the average interbank exchange rate on the previous day. In July 2002 this trading band was widened to 0.25 per cent. Recently, in December 2006, the trading band for USD/VND exchange rate was relaxed to 0.5 per cent. The IMF (2005) noted that the SBV has tried to limit the depreciation of the exchange rate in the range of 1 to 2 per cent per year in recent years[21].

The third instrument is interest rate control. The SBV could control the interest rate in the money market by regulating the deposit and lending rates of both domestic and foreign currencies. However, since 1996 the SBV has gradually abolished most types of interest rate controls.

[21] In January 2005 the IMF classified the exchange rate regime of Vietnam to the category of conventional pegged arrangements.

The fourth instrument is open market operations. This instrument of monetary policy was introduced in 1998 and was considered an important component of financial sector reform. Open market operations are carried out by outright sales and purchases of securities or repurchase agreements. Initially, due to the requirement that only Treasury bills and short-term SBV bills (shorter than one year) are eligible to be traded, the use of open market operations was limited because the participants found it difficult to obtain a desired level of risk and asset diversification (Kovsted *et al* 2005). In 2003 securities with maturity of more than one year are allowed to be traded. Thus, since 2003 the open market operations have been frequently used as a key instrument for the SBV to achieve monetary policy targets (IMF 2005). Other indirect monetary instruments such as rediscounting, refinancing and SWAP arrangements for foreign exchange have also been used by the SBV. The rediscount and refinancing instruments require commercial banks to have collateral in the form of valuable papers or bonds for their borrowings. However, there is a quota for rediscount for each commercial bank. The rediscount rate is the lower interest rate and the refinancing rate is the upper rate for lending from the SBV. Together they define the band of interest rate for open market operations.

Another instrument that the SBV has used is credit control. The SBV applied selectively the credit growth limit with some banks, mainly joint-stock banks, in order to control the financial stability in those banks (Kovsted *et al* 2005). Furthermore, in managing creit activity in banking system, the SBV also give instructions on proportion of foreign currency lending and the usage of short term funds for medium and long term lending (SBV 2006). Finally, policy-based lending is also considered a type of monetary policy

instrument. Although the operation of policy-based lending has been gradually separated from the SOCBs to a newly established specialized bank, the lending operations of SOCBs still follow instructions from the SBV in some cases. For example, in 2000 the SBV instructed the SOCBs to give preference to loans for the import of fertiliser and for the export of rice[22] and promised to use the refinancing instrument to support the SOCBs. Similar conditions also applied to syndicated loans offered by SOCBs to major industrial projects which are exempted from certain prudential regulations (IMF 2003).

[22] Circular 01/2000/TT-NHNN14 by the Governor of the SBV on guidance on ensuring bank loans to import fertiliser and gather rice for export.

3.5 Monetary policy and dollarization in Vietnam

The Banking Law of Vietnam Article 2 stipulates that national monetary policy serves three purposes: to stabilise the value of the Vietnamese currency, manage inflation and encourage economic development. This objective is broad and the State Bank of Vietnam (SBV) has a difficult and complex responsibility. Williamson (2001) and Camen (2006) argues that in theory, the combination of pegged exchange rate with a horizontal band and control of both capital inflows and outflows[23] of Vietnamese firms and residents would allow the SBV to retain the independence of its monetary policy with some sterilization.

Another problem for the SBV in operating its monetary policy is the use of US dollars in the Vietnamese economy. The SBV regulations[24] allow Vietnamese firms and residents to open and maintain foreign currency (time and savings) deposits. Because there are no reliable data on the foreign currencies in circulation, the ratio of foreign currency deposits (FCD) in the banking system over broad money is usually used as a proxy for the degree of dollarization in Vietnam. According to the Balinos *et al* (1999), a country is classified as a moderately dollarized economy if the ratio of FCD over broad money is lower than 30 per cent. Figure 3.2 shows that, on average, Vietnam would be considered a moderately dollarized economy.

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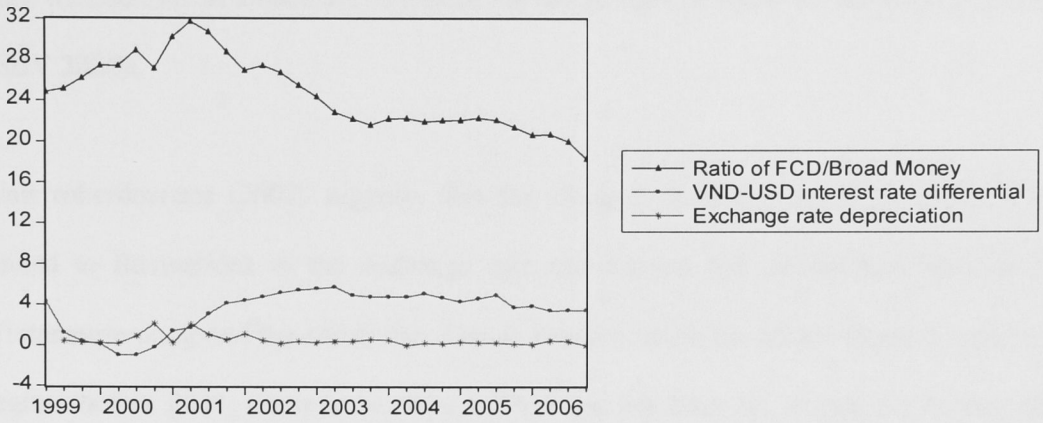
[23] SBV Decision No.160/QD-NH7 dated 08/06/1996 and Decision No.1437/2001/QD-NHNN dated 19/11/2001 on capital account and current account controls.

[24] SBV's Circular No.01/1999/TT-NHNN7 on mobilization of foreign currency deposits in the banking system.

Figure 3.2 **Foreign currency deposits in Vietnam, 1999-2006**



Note: The vertical axis is in per cent.

Source: Author's calculations.

The legal framework in Vietnam has a notable point which may help to limit dollarization. Foreign currencies are not allowed as legal payment in the domestic market (SBV 2000). The Vietnamese dong (VND) is the only legal means of payment in the domestic clearing system. Thus, if a firm has foreign exchange and has to pay a debt to another firm, although the latter may need foreign exchange, the former has to sell its foreign exchange to a bank and make the payment in VND. The latter uses the received money to buy foreign exchange from a bank.

However, households use foreign currencies, the US dollar in particular, as an unofficial medium of exchange outside the banking system because of its convenience in facilitating large transactions (IMF 2003). Before 2004, the largest single denomination of Vietnamese currency notes was equal to approximately USD 6 (the largest and most commonly used of US dollar notes is USD 100). Since the start of 2004 a larger

denomination note, worth approximately USD 30, has been introduced to facilitate large cash transactions as a measure to reduce the use of the US dollar in unofficial payments (SBV 2004).

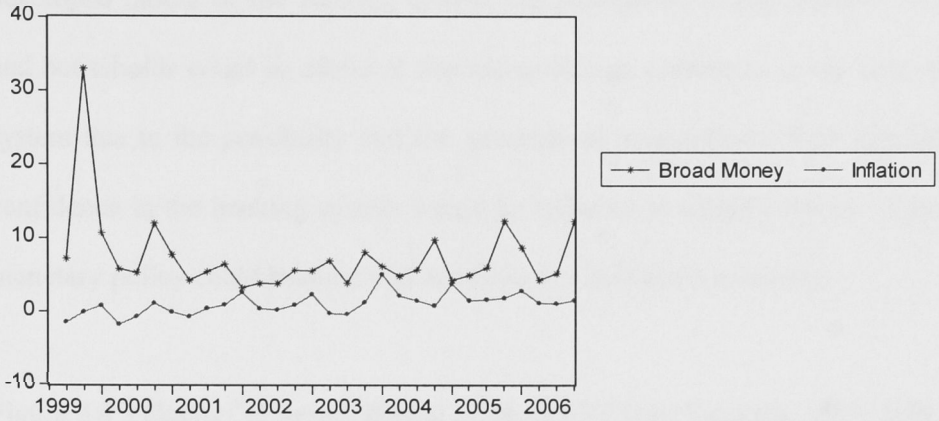
Unterroberdoerster (2002) suggests that the changes in foreign currency deposits are linked to fluctuations in the exchange rate and interest rate differential between the Vietnamese dong and the US dollar. This is because under the administered interest rate regime before 2001, the interest rate on VND had not been set so that the interest rate parity between VND and USD was maintained. Figure 3.2 shows that in the period 1999-2001, the interest rate differential between the VND and USD, after taking into account the depreciation of VND, was in favor of USD deposits. This led to an increase in the ratio of FCD/broad money in this period.

In theory, the existence of dollarization can affect the effectiveness of a country's monetary policy. However, the SBV can influence the use of foreign currencies in the domestic market by requiring banks to maintain reserve requirements for foreign currency deposits. Also, studies by Ngo (1997) on dollarization and Vo (1997) on inflation stabilization in Vietnam in the period 1989-95 show that reduction in the money supply was the main reason for Vietnam achieving lower inflation. This means that, in practice, monetary policy was still effective in this period although Vietnam experienced moderate levels of dollarization.

Figure 3.3 shows the similar movement of broad money growth and inflation in Vietnam during the period 1999-2006. This suggests that the growth in broad money (including

foreign currency deposits) might help to explain the fluctuation of inflation in this period.

Figure 3.3 **Inflation and broad money (including FCD) growth in Vietnam, 1999-2006**



Note: The vertical axis is in per cent.

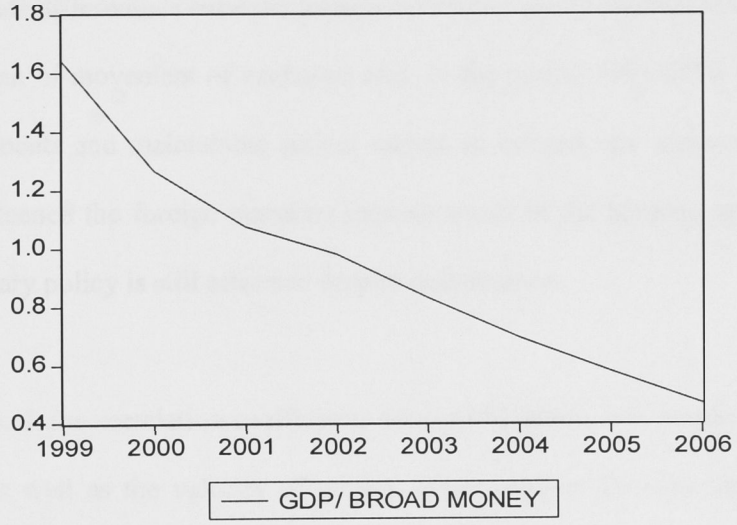
Source: Author's calculations.

Studies by Reinhart *et al* (2003) on dollarization in developing countries also find a clear link between changes in monetary aggregates and inflation. They conclude that high dollarization does not seriously impede the effective conduct of monetary policy in economies with regard to inflation control.

Reinhart *et al* (2003) also suggest another way to assess the effectiveness of monetary policy in a dollarized economy, by evaluating the velocity of money. According to the quantity theory of money, the demand for money multiplied by the velocity of money equals the price multiplied by output: MV=PY. As dollarization usually occurs in economies which experience high inflation, inflation and dollarization would make the demand for domestic money unstable and less predictable. Furthermore, they argue that

the credibility of the exchange rate peg also has a large impact on dollarization and money demand. Households and firms could prefer foreign currencies as a store of value and a medium of exchange if they expect devaluation. Hence, given the generally under-developed nature of the banking system and prevalence of government controls, firms and households could be afraid of depositing foreign currencies in the domestic banking system due to the possibility that the government would freeze their deposits. The low confidence in the banking system would be reflected in a high velocity of money. Thus, monetary policy could become less effective in a dollarized economy.

Figure 3.4 **Velocity [6]of broad money including FCD in Vietnam, 1999-2006**



Source: Author's calculations.

However, the evidence in Vietnam in the period 1999-2006 does not support this view. Velocity of broad money has been declining gradually despite changes in the

[6] Velocity of broad money is measured as the ratio of GDP to the end of period broad money.

dollarization level. Two inferences can be made from the behavior of money velocity. First, the lower inflation has reduced the opportunity cost of holding domestic currency and might make the demand for domestic currency more stable. Second, the acceptance of foreign currency deposits in the domestic banking system appears to have a positive effect on the financial deepening of the economy because it facilitates the re-intermediation of foreign currencies in the economy[25]. To a certain extent, the movement of foreign currency deposits in the banking system may also reflect the public's confidence in the SBV's monetary policy and the domestic banking system. Firms and households only maintain foreign currency deposits when they believe in the soundness of the banking system. In this case the fluctuations of foreign currency deposits depend on the interest rate differentials between foreign currencies and domestic currency as well as the expectation of movement of exchange rate. In the period 1999-2006, the SBV by using its instruments and maintaining proper targets in interest rate and exchange rate, was able to influence the foreign currency deposit levels in the banking system. Thus, domestic monetary policy is still effective despite dollarization.

In conclusion, both the correlation coefficients between inflation rate, money growth and GDP growth, as well as the velocity of money, could support the view that monetary policy is still effective in Vietnam despite dollarization.

[25] Balinos *et al* (1999) also argue that allowing FCD in the domestic financial system enhances the opportunity for re-intermediation in the economy, facilitates the integration of the domestic market into the world market and lowers the cost of international financial transaction.

CHAPTER 4 STRUCTURAL VECTOR AUTOREGRESSION MODEL OF MONETARY TRANSMISSION MECHANISM IN VIETNAM

4.1 Structural Vector Autoregression (SVAR) model

Two types of econometric model are often used in analyzing the monetary transmission mechanism: the structural macro econometric model and the structural vector autoregression model. The structural macro econometric model has been criticized for its theoretical and econometric assumptions (Sims 1980). Thus, most empirical studies on the effects of monetary policy use a structural vector autoregression (SVAR) approach proposed by Sims (1980). An SVAR model is a system of equations providing the interactions between the current values of each variable in the system and past values of all variables. An SVAR model allows the use of a small number of key variables and applies minimum restrictions in order to analyze the effect of monetary policy shocks on an economy without a need to explain the very large number of variables.

Consider the simple three variable system:

$$y_t = - b_{12}z_t - b_{13}g_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \gamma_{13}g_{t-1} + \varepsilon_{yt} \quad (1)$$

$$z_t = - b_{21}y_t - b_{23}g_t + \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \gamma_{23}g_{t-1} + \varepsilon_{zt} \quad (2)$$

$$g_t = - b_{31}y_t - b_{32}z_t + \gamma_{31}y_{t-1} + \gamma_{32}z_{t-1} + \gamma_{33}g_{t-1} + \varepsilon_{gt} \quad (3)$$

where it is assumed that y_t, z_t and g_t are stationary; ε_{yt}, ε_{gt} and ε_{zt} are white noise disturbances and uncorrelated to each other. Equations (1); (2) and (3) are called a primitive system. The primitive system can not be estimated directly due to multicollinearity problem – the correlation between regressors and error terms.

We can also write the system as:

$$y_t + b_{12}z_t + b_{13}g_t = \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \gamma_{13}g_{t-1} + \varepsilon_{yt} \quad (4)$$

$$b_{21}y_t + z_t + b_{23}g_t = \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \gamma_{23}g_{t-1} + \varepsilon_{zt} \quad (5)$$

$$b_{31}y_t + b_{32}z_t + g_t = \gamma_{31}y_{t-1} + \gamma_{32}z_{t-1} + \gamma_{33}g_{t-1} + \varepsilon_{gt} \quad (6)$$

Using matrix algebra, we can write the system as:

$$B_0x_t = B_1x_{t-1} + \varepsilon_t \quad (7)$$

In which $B_0 = \begin{bmatrix} 1 & b_{12} & b_{13} \\ b_{21} & 1 & b_{23} \\ b_{31} & b_{32} & 1 \end{bmatrix}$ $B_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{bmatrix}$ $x_t = \begin{bmatrix} y_t \\ z_t \\ g_t \end{bmatrix}$ $\varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \\ \varepsilon_{gt} \end{bmatrix}$

Pre-multiplying with B_0^{-1} then the reduced form or standard form will be:

$$x_t = A_0x_{t-1} + e_t \quad (8)$$

$$\text{where } A_0 = B_0^{-1}B_1 \quad (9)$$

$$\text{and } e_t = B_0^{-1}\varepsilon_t \qquad \text{or } \varepsilon_t = B_0e_t \quad (10)$$

We can define a_{ij} as an element in row *i* and column *j* of the matrix A, and e_{it} as an element *i* of the vector e_t. The reduced-form equations, which contain past variables only, can be estimated directly:

$$y_t = a_{11}y_{t-1} + a_{12}z_{t-1} + a_{13}g_{t-1} + e_{yt} \quad (11)$$

$$z_t = a_{21}y_{t-1} + a_{22}z_{t-1} + a_{23}g_{t-1} + e_{zt} \quad (12)$$

$$g_t = a_{21}y_{t-1} + a_{22}z_{t-1} + a_{23}g_{t-1} + e_{gt} \quad (13)$$

However, the number of parameters of the primitive system is larger than that of the reduced form model. Thus we need to impose some restrictions in order to recover

information from the estimated system through the contemporaneous relationship or vector B_0.

There are two ways of recovering the parameters. The most common identification scheme is the recursive assumption in which shocks are transmitted between variables in the system in a one-way restriction. This is often called the Choleski decomposition. It restricts the contemporaneous matrix of structural coefficients (matrix B_0) to be the lower triangular and all coefficients to be above are zero (Enders 1995). In the primitive system of equations (4), (5) and (6), for example, the coefficients $b_{12,}$ b_{13} and b_{23} could be restricted to zero. Then we have a new system:

$$y_t = \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \gamma_{13}g_{t-1} + \varepsilon_{yt} \quad (14)$$

$$b_{21}y_t + z_t = \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \gamma_{23}g_{t-1} + \varepsilon_{zt} \quad (15)$$

$$b_{31}y_t + b_{32}z_t + g_t = \gamma_{31}y_{t-1} + \gamma_{32}z_{t-1} + \gamma_{33}g_{t-1} + \varepsilon_{gt} \quad (16)$$

Given the restrictions (which might be suggested by a particular economic model), it is clear that g_t does not have contemporaneous effects on y_t and z_t but y_t has contemporaneous effects on both z_t and g_t. Thus, the impulse responses resulting from the recursive system depend on the causal ordering of the variables involved. Therefore, different assumptions of how variables in the model interact with each other will lead to different orderings of variables. Hence, it should be noted that the results of the recursive VAR system, such as impulse response functions and variance decomposition obtained from different ordering schemes, may be different.

The other identification scheme is the non-recursive approach which does not require the structural matrix of coefficients (matrix B_0) to be the lower triangular. For example in the system of equations (4), (5) and (6), the coefficient b_{21} is restricted to zero (this restriction might be suggested by a specific economic argument). Then we have a new system of equations as follows:

$$y_t + b_{12}z_t + b_{13}g_t = \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \gamma_{13}g_{t-1} + \varepsilon_{yt} \quad (17)$$

$$z_t + b_{23}g_t = \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \gamma_{23}g_{t-1} + \varepsilon_{zt} \quad (18)$$

$$b_{31}y_t + b_{32}z_t + g_t = \gamma_{31}y_{t-1} + \gamma_{32}z_{t-1} + \gamma_{33}g_{t-1} + \varepsilon_{gt} \quad (19)$$

Thus, with this non-recursive assumption, any shock to any variable in the system will affect other variables contemporaneously. Therefore, results obtained from the model depend on the specific non-recursive assumptions applied to the structural matrix of coefficients (matrix B_0).

However, not only benefits but also costs come with the SVAR model. First, is the difficulty in interpreting the outcomes. An SVAR model focuses on estimating the impulse response functions and variance decomposition function instead of the parameter coefficients. Second, is the assumption of a recursive structure or non-recursive structure on the system of endogenous variables in the SVAR model and the economic theory to support that assumption. Although there are some costs, the SVAR model is widely used in research on monetary policy because it makes few assumptions on the structure of the economy and focuses on obtaining good representation of interactions between policy and economic variables, which appear to be the main concern of policy makers (Morsink and Bayoumi 2001, Fung 2002)

Existing empirical studies on the effects of monetary policy using the recursive approach find evidence of several 'puzzles' (Kim and Roubini 2001). First, is the 'liquidity puzzle': a positive shock on monetary policy identified by an increase in monetary aggregate leads to an initial increase rather than a decrease in nominal interest rate. Then, is the 'price puzzle': monetary tightening identified by an increase in interest rate leads to an initial increase rather than a decrease in price level. Third, is the 'exchange rate puzzle': when an increase in interest rate leads to a depreciation instead of an appreciation of the nominal exchange rate. Finally, is the 'forward discount puzzle': if the uncovered interest parity holds, a rise in the domestic interest rate mean an increase in the domestic and foreign interest differential and that should lead to a persistent depreciation over time after initial appreciation. However, evidence from empirical studies suggests that appreciation after the increase in interest rate differential is rather persistent than expected. In addition to these four puzzles, some studies such as Bernanke and Mihov (1995) find the 'output puzzle': a loosening monetary policy lead to output to fall slightly before beginning to increase.

To solve the 'puzzles' some researchers explore the non-recursive approach that allows the monetary shocks to be transmitted contemporaneously between variables in the monetary reaction functions in two directions. In this case, more economic relationships in the structural VAR model need to be identified because the structure of the economy and the central bank's reaction function are explicitly modeled. Non-recursive structural VAR models appear to give reasonable explanations of monetary transmission

mechanisms in G-7 countries excluding the US (Kim and Roubini 2000), in Australia (Brischetto and Voss 1999) and in Thailand (Sodsrichai 2006).

Although different identification schemes have been applied, there is some consensus on how monetary shocks are transmitted (Christiano *et al* 1998). These transmissions often reflect the conventional economic framework and serve as a guide to whether a particular identification scheme is reasonable or not.

4.2 A recursive structural VAR model for monetary transmission in Vietnam

As explained in the previous chapter, the banking sector in Vietnam was gradually reformed during the period 1990-8, and it moved towards a system where banks were beginning to operate on a commercial basis. This study focuses on the period 1999-2006 because the conditions in this period generally satisfy the requirements for analyzing the monetary transmission process. First, interest rate controls were gradually deregulated. Second, accounting methods in the banking system were being implemented in accordance with international standards. However, there is debate on the implementation of new accounting methods and valuation of non-performing loans (IMF 2006). Third, despite the issue of dollarization in the economy, the SBV was able to maintain the effectiveness of its monetary policy, as has been explained in Chapter 3.

After the Asian Financial Crisis in 1997-8, as foreign direct investment to Vietnam slowed down, monetary policy and the banking system have seemed to play a more important role in promoting growth in Vietnam (Gottschang 2001). Facing the slowdown

in economic activity the SBV used its monetary instruments as well as moral suasion to relax monetary conditions in the market[26]. It is probable that, since 1999, monetary policy in Vietnam has changed from a tightening to a prudent loosening policy (Pham and Vo 2005). However, the growth rate remained stable at 5-6 per cent per annum and the inflation rate at under 3 per cent per annum in the period 1999-2002. In the period 2003-2006, the growth rate, and especially the inflation rate, rose rapidly to 6-8 per cent per annum. In response to the threat of high inflation, the SBV has changed to a prudent tightening policy in recent years (IMF 2005). Thus, this paper examines the transmission of monetary policy from 1999 to 2006 – that is, from monetary tightening to loosening and then back to tightening again.

Pham and Vo (2005) use a recursive VAR model to analyze the transmission mechanism of monetary policy in Vietnam for the period 1991-2004. It consists of four variables: industrial output, consumer price index, total liquidity, and nominal exchange rate between the US dollar and Vietnamese dong. All variables are considered endogenous in this VAR model. In their model, Pham and Vo (2005) assume that the SBV influences output and price by changing money supply. Due to the reforms in Vietnam's banking system and changes in the implementation of monetary policy during this period, they divide their analysis into two periods: 1991-8 and 1999-2004. The estimation results for the first period seem to follow theory: monetary loosening represented by an increase in

[26] Circular No.01/1999-TT dated 29/01/1999 on reducing the Vietnam dong interest rate offered by SOCBs to customers in urban areas and Circular No.04/1999-TT dated 23/08/1999 on implementing Government resolution No.08/1999/NQ-CP on measures to execute the main tasks of 1999.

monetary aggregate leads to increases in output and prices, and a depreciation of the nominal exchange rate.

In the period 1999-2004, Pham and Vo (2005) find that an increase in money supply led to decreases in output and prices, and an appreciation of the exchange rate in 8 to 10 months after the increase in monetary supply. After that, output and prices increase, and exchange rate depreciates. Thus, Pham and Vo conclude that in the months after the increase in money supply, the responses of output, prices and exchange rate are not consistent with theory. Interest rate is not included in this model, thus it is not known whether the "liquidity puzzle" occurs in that period.

It could be that the deregulation process that occurred in this period affected the measurement and depth of monetary aggregates. First, this was due to the rapid deepening level of monetization in the Vietnamese economy with the share of banking credit increasing as a proportion of GDP from 32 per cent in 1998 to nearly 60 per cent in 2004[27]. Second, was the increase in the number of commercial banks and non-bank financial institutions (financial companies, insurance companies, leasing companies, postal saving, and security companies)[28] and the increasing competition in traditional products, such as deposits and credit, as a result of interest rate deregulation (IMF, 2003). Third the product range offered was extended to those such as credit cards, mortgages,

[27] Author's calculations.

[28] The data on monetary aggregate for 1998 comprise four state-owned commercial banks and 24 non state-owned banks. Data on some banks and credit institutions are not covered in the monetary aggregate. Thus, data from 1999 onwards comprise six state-owned commercial banks and 83 non-state credit institutions.

credit lines, convertible bonds and foreign exchange services (WB 2002). Thus it is possible that the assumption that the SBV followed a monetary targeting policy in this period might not be appropriate.

When the interest rate (deposit rate) is used in the model instead of money supply as a proxy for changes in monetary policy, Pham and Vo (2005) examine the responses of other variables to an increase in the interest rate and find that money supply decreases permanently as expected but output and prices decrease for a few months and then increase permanently. Thus, the "price puzzle" does occur in the long run. The nominal exchange rate depreciates initially and then appreciates. Thus, Pham and Vo view the exchange rate impact as contrary to theory. Although the exchange rate is considered as endogenous in the model, Pham and Vo do not consider the exchange rate shock in their model[29]. Overall, they conclude that the results for the period 1999-2004 show that the responses of the variables in their model seem not to be consistent with accepted theory.

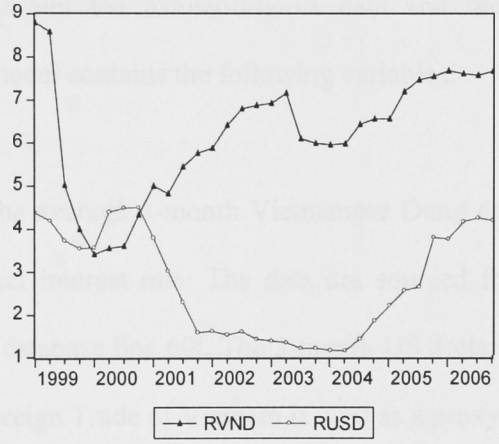
4.3 Data for the model

This thesis sets up and analyzes a recursive model for monetary transmission in Vietnam as a basis for research. This study also analyzes the impact of monetary policy on the Vietnamese economy after the Asian financial crisis, but with some notable differences from the model used by Pham and Vo (2005). First, the US dollar interest rate in Vietnam is included in the model as a proxy for the impact of the world economy on Vietnam's economy and on the dollarisation situation in Vietnam. The movements of US dollar

[29] The reason for that might be because Vietnam follows a pegged exchange rate regime as has been explained in Chapter 3 (section 3.3).

interest rate play a crucial role in monetary policy decision making of the SBV[30]. In the research period 1999-2006, the trends in Vietnamese dong interest rates and domestic US dollar interest rates are different. Therefore, it is reasonable to differentiate the impact of interest rates on the economy. Figure 4.1 shows the movements of Vietnamese dong and US dollar interest rates in the period 1999-2006.

Figure 4.1: **Movements of Vietnamese dong and domestic US dollar interest rates, 1999-2006**



Note: The left hand side axis is interest rate in percent.

Source: Author's calculations.

Second, because of significant dollarization in Vietnam, the movements of foreign currency deposits and Vietnamese Dong (VND) total liquidity will be differentiated. Because there is no data on the amount of foreign currencies circulating as cash outside the banking system, the amount of foreign currency deposits in the banking system is considered as a proxy for dollarisation. Third, the exchange rate is considered as

[30] The SBV has acknowledged this practice in several quarterly and annual reports.

exogenous in the model because the fluctuation of nominal exchange rate is under the close scrutiny and control of the SBV[31]. The nominal exchange rate is allowed to trade in a -/+ 0.25 per cent trading band around the official exchange rate stipulated by the SBV (SBV 2005). In the research period 1999-2006, the nominal exchange rate depreciated on average only 1.3 percent per annum. Overall, the objective of this research is to illustrate and quantify the magnitude and the timing of the effect of different monetary policy shocks on output and prices.

Taking into account the availability of data and the condition of the Vietnamese economy, our model contains the following variables:

Interest rates: the average 3-month Vietnamese Dong deposit rate (RVND) is used as a proxy for market interest rate. The data are sourced from the *International Financial Statistics* (IFS) database line 60l. The 3-month US dollar deposit rate (RUSD) offered by the Bank for Foreign Trade of Vietnam is used as a proxy for the domestic US dollar rate.

Monetary aggregate: broad money which is considered as a proxy for monetary aggregate is the sum of data in line 34 (usually referred to as M1), line 35 (Quasi-money), and line 26 (bond and money market instruments) in the IFS database. Data on foreign currency deposits are from line 25b in the IFS database and are a component of Quasi-money.

[31] If the nominal exchange rate is considered as an endogenous variable in the model, its movements after a shock to other variables such as interest rate or monetary aggregate are unrestricted. This response of exchange rate contradicts to the real situation of Vietnam in the research period.

Broad money is divided into Vietnamese dong monetary aggregate (VND) and foreign currency deposits (FCD).

Consumer price index (CPI): is a monthly index with base year 1994 as 100. Data are from the CEIC database and the Vietnam General Statistical Office.

Output (Y): because the quarterly data for Vietnam GDP is available in recent years, industrial production is used as a proxy for output in period 1999-2006. Data for the real industrial output are from the CEIC database and the Vietnam General Statistical Office using constant price. The GDP data for period 2001-6 are from Vietnam General Statistical Office using constant price.

The nominal exchange rate (EX) is defined as end of period exchange rate of Vietnamese dong per 1 US dollar, from IFS database.

All variables are used in logarithm form except interest rates. The analysis is estimated using the quarterly data from 1999.2 to 2006.4 giving a total of 31 observations. All variables are adjusted for seasonality.

4.4 Recursive structural VAR model (Model 1)

This section firstly explains what restrictions apply to the recursive VAR model. The details of the VAR approach, including the explanation of a primitive form, reduced form, the stability of VAR model, the ways to identify restrictions in the primitive system, the derivations of the impulse response function and variance decomposition, are presented in Appendix A.1. Second, the optimal lag length or the order of the VAR model and the stability of the model are analyzed. Third, diagnostic tests of each equation of the VAR model are investigated. Finally, the results of VAR estimation using a recursive assumption including impulse response functions and variance decomposition are discussed.

In our recursive VAR model, the ordering of variables is: Output (Y), prices (CPI), Vietnamese dong broad money (VND), foreign currency deposits (FCD), interest rate on Vietnamese dong deposits (RVND) and interest rate on US dollar deposit (RUSD). In addition to a constant, the VAR model also contains the nominal exchange rate (EX) to control for the gradual devaluation of the pegged exchange rate in this period.

The ordering of the variables in our recursive VAR model follows the argument proposed by Bernanke and Mihov (1998): Non-policy variables (output and prices) come first and then policy-related variables (monetary aggregate, interest rate, exchange rate). The order reflects implicit assumptions about the dynamic structure of Vietnam's economy. Namely, industrial output is not affected contemporaneously by shocks to other variables in the system. Prices are influenced contemporaneously by changes in output. However,

both output and prices are not contemporaneously affected by a shock to policy-related variables within the same period. Changes in output and prices lead to changes in monetary aggregates of both Vietnamese dong and foreign currencies. Because the Vietnamese dong is the main currency for transactions in Vietnam, Vietnamese dong monetary aggregate is assumed to respond first to changes in output and prices. Then, foreign currency monetary aggregate, represented by foreign currency deposits, is affected by changes in output, prices and domestic monetary aggregate.

In light of the changes in output, prices and conditions in the money market, the SBV could determine interest rates of domestic currency and US dollar deposits by using direct or indirect monetary instruments. Changes in the monetary aggregates and interest rates are assumed to impact on output and prices in the next period. The SBV is also able to set the pegged exchange rate and defend it in the short term.

The objectives of SBV monetary policy to stimulate output or control inflation depend on the specific circumstance of the economy at that time and Vietnamese government policy in that period. Because the central bank in Vietnam is under the control of the government the central bank is not absolutely independent in its operation. Although the government and central bank might have announced the objectives of their operations in certain periods to the public, the timing and magnitude of central bank actions to achieve those objectives are still considered as shocks to the public.

4.4.1 Restrictions of the recursive structural VAR model

Table 4.1 shows the recursive VAR identification for the Vietnamese economy proposed in this research.

Table 4.1: **Vietnam-Recursive identification of VAR system**

Equation (10) $\varepsilon_t = B_0 e_t$ can be written as:

$$
\begin{array}{c}
\\
1 \\
2 \\
3 \\
4 \\
5 \\
6
\end{array}
\begin{bmatrix} \varepsilon_Y \\ \varepsilon_{CPI} \\ \varepsilon_{VND} \\ \varepsilon_{FCD} \\ \varepsilon_{RVND} \\ \varepsilon_{RUSD} \end{bmatrix}
=
\begin{bmatrix}
b_{11} & & & & & \\
b_{21} & b_{22} & & & & \\
b_{31} & b_{32} & b_{33} & & & \\
b_{41} & b_{42} & b_{43} & b_{44} & & \\
b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & \\
b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66}
\end{bmatrix}
\begin{bmatrix} e_Y \\ e_{CPI} \\ e_{VND} \\ e_{FCD} \\ e_{RVND} \\ e_{RUSD} \end{bmatrix}
$$

Note: Coefficients on the main diagonal of matrix B_0 equal 1.

Source: Author's calculations.

These assumptions might be reasonable and consistent with actual behavior of the Vietnamese economy. Firstly, firms do not change their output and prices unexpectedly in response to unanticipated changes in monetary policy within the same period due to adjustment costs and planning delays while the SBV could set monetary policy quickly in response to development in output and prices. This assumption is reasonable because the SBV could implement monetary policy in the framework given by the National General Assembly to assist the economy to achieve certain targets in output and inflation. Thus, both output and prices do not react to changes in financial variables contemporaneously.

Furthermore, changes in the level of output commonly affect changes in price level. Hence, prices are assumed to respond to output immediately.

Secondly, the changes in prices and output lead to changes in demand and supply of monetary aggregates in the economy. In this model, the monetary aggregate equations for Vietnamese dong and foreign currencies, based on money demand, are represented by equations in lines 3 and 4 in Table 4.1. The monetary aggregate equations, based on money supply, are represented by equations in lines 5 and 6 in Table 4.1. In this recursive VAR model, it is assumed that the SBV has contemporaneous information on output and prices when setting its monetary policy[32].

Thirdly, as Vietnam follows the pegged exchange rate regime with the US dollar and maintains capital control, the SBV could set the domestic interest rate relatively independently from world levels (US Federal Fund Rate in this case). Because commercial banks have to maintain reserve requirements for their foreign currency deposits, the SBV could influence the domestic US dollar interest rate and the level of foreign currency deposits in the banking system by adjusting the reserve requirement ratio[33]. However, the room for the SBV to manipulate the domestic US dollar rate is limited when the US Federal Reserve lowers the Federal Fund Rate. The shocks to domestic US dollar interest rate may come from the SBV or the US Federal Reserve actions.

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[32] This assumption will be relaxed in the non-recursive VAR model presented in Section 4.5.

[33] The SBV could also influence the domestic US dollar interest rate by adjusting the ceiling interest rates regarding foreign currency deposits applied to legal entities. This control of interest rate is removed in March 2007.

4.4.2 Lag length and the stability of the VAR system

The unit root test finds that most variables are *I(1)*, that is, non-stationary in levels but stationary in first differences. Definition, sources and results of the unit root test of all variables are presented in Appendix A.2.

The question of choosing between a VAR estimation in first differences or in levels has been discussed in some previous studies. Brischetto and Voss (1999) mention that there is a trade-off between the loss of information about the dynamic relationships in the data when the VAR is estimated in first differences, and the loss of efficiency when the VAR is estimated in levels. Sims *et al* (1990) show that while an estimation of VAR in levels may provide efficiency loss, its parameters are estimated consistently by least squares. Furthermore, a VAR in first differences provides no information on the relationships between levels of the variables in the VAR system, and this aspect of economic theory is usually most informative (Disyatat and Vongsinsirikul 2002). Therefore, most of the empirical literature using a VAR model has tended to be estimated in levels. This study accepts the same procedure and VAR models are estimated in levels. Table 7 shows the results of tests to choose the lag length of the model.

Table 4.2 **Lag length test of the VAR system**

Lag	LR	FPE	AIC	SC	HQ
0	NA	6.67e-12	-8.707	-8.142	-8.530
1	263.61*	3.08e-16*	-18.778*	-16.514*	-18.069*
2	29.36	8.06e-16	-18.253	-14.292	-17.012

Note: The asterisk presents the optimal lag length suggested by each criterion.

Source: Author's calculations.

It is essential to determine the appropriate lag length of the VAR system. Several criteria are usually used to determine the appropriate lag length of the VAR system: the likelihood ratio test, the Akaike information criterion (AIC), the Schwarz criterion (SC), the final prediction error and the Hannan-Quinn information criterion (HQ). The lag length of the VAR system based on lag order selection criteria (the lowest absolute values) is one quarter.

The stability test of the VAR system, by considering the inverse roots of the characteristic AR polynomial, shows that the estimated VAR system is stable. That is, all roots have a modulus less than one and lie inside the unit circle. Thus the standard errors in the impulse responses in the model are valid. The normality test and serial correlation test of the recursive VAR system provide satisfactory outcomes (Appendix A.2).

4.4.3 Diagnostic tests of equations in the VAR system

Table 9 presents the diagnostic tests equations, namely normality, serial correlation and heteroskedasticity tests of errors, as well as the RESET test of functional form for each equation in the VAR system. The null hypotheses have no serial correlation (errors are serially uncorrelated), no heteroskedasticity (variances of errors are homoskedastic), and no functional form mis-specification, but they normality (errors are normally distributed).

Diagnostic tests of each equation generally provide satisfactory outcomes. The results show that the errors of all equations are normally distributed. This is because the null hypothesis of normally distributed errors cannot be rejected at the significant level. The

results also show most equations have no serial correlation, no heteroskedasticity, and no functional form mis-specification. Only the equations representing the foreign currency aggregate and Vietnamese dong interest rate show evidence of mis-specification. The reason for having mis-specification may be due to the omission of explanatory variables. The volume of foreign currency deposits in Vietnam's banking system and the interest rate of Vietnamese dong may also depend on the price of gold in the market, because in Vietnam gold is also widely used as an alternative means to store value and as a medium for transaction. The presence of functional form mis-specification may cause biased ordinary least square estimators. However, in the VAR system the main goal is to analyze the dynamic relationships among variables in the system rather than the estimation of parameters in any particular equation (Ender 1995). Therefore, the presence of functional form mis-specification in two equations in the VAR system may not be of major concern in this study.

In the presence of serial correlation, the ordinary least square estimators are unbiased but inefficient. However, as mentioned above, the main objective of the VAR model is to analyze the inter-relationships among variables in the system rather than the parameter estimates in any particular equation. Furthermore, the stability of the VAR system discussed in the previous section suggests that the standard errors of the impulse responses, which are the keys in the VAR analysis, are valid.

Table 4.3 **Diagnostic tests of each equation in the VAR system**

Diagnostic Test		Y	CPI	VND	FCD	RVND	RUSD
Normality of	JB	0.269	0.753	3.624	3.963	0.198	2.91
Errors		*0.874*	*0.686*	*0.163*	*0.138*	*0.905*	*0.233*
Serial correlation of	F	0.0067	0.224	0.311	4.174	0.12	1.216
errors		*0.935*	*0.641*	*0.583*	*0.054*	*0.732*	*0.283*
	LM	0.0096	0.317	0.438	4.974	0.171	1.642
		0.922	*0.573*	*0.508*	*0.026*	*0.679*	*0.200*
Heteroskedasticity	F	0.097	0.021	0.277	5.23	2.542	0.022
of errors		*0.757*	*0.886*	*0.602*	*0.03*	*0.122*	*0.883*
	LM	0.104	0.022	0.295	4.705	2.495	0.023
		0.747	*0.881*	*0.587*	*0.03*	*0.114*	*0.878*
Functional form	F	0.006	0.574	1.764	3.227	4.123	0.332
(RESET)		*0.94*	*0.457*	*0.198*	*0.087*	*0.055*	*0.570*
	LL	0.008	0.809	2.420	4.288	5.377	0.472
		0.927	*0.368*	*0.119*	*0.038*	*0.021*	*0.492*

Note:

1. Sample period is Q2/1999-Q4/2006.
2. The test for normality is the Jarque-Bera test. The test for serial correlation is the Breusche-Godfrey serial correlation Lagrange multiplier test with one lag. The test for heteroskedasticity is the ARCH test. The test for specification and stability is the Ramsey RESET test with 1 fitted residual.
3. F is F-statistics. LM is Lagrange multiplier test computed by the number of observations (T) times R-squared. LL is log-likelihood ratio for testing a functional form.
4. The null hypotheses are: normally distributed errors, no serial correlation, no heteroskedasticity and no functional form misspecification.
5. Italicized values are the p-values for which the null hypothesis cannot be rejected.

Source: Author's calculations.

4.4.4 Estimation results and interpretation

This section shows the estimated impulse responses of all variables in the recursive VAR model to shocks in monetary policy presented by Vietnamese dong interest rate, domestic US dollar interest rate and Vietnamese dong monetary aggregate. A shock to a variable in the model not only directly affects this variable but is also transmitted to all other variables through the contemporaneous relationships at the period the shock occurs and then through the lag structure of the VAR system. The study in this section analyzes the impulse responses of variables in the VAR system to one-time shocks to Vietnamese dong interest rate, Vietnamese dong monetary aggregate, and domestic US dollar interest rate using the Choleski decomposition (recursive identification). After that, forecast variance decomposition is examined.

4.4.4.1 Impulse responses to a Vietnamese dong interest rate shock

Figure 4.2 shows the responses of all variables in the VAR model to a one-time one percentage point increase in Vietnamese dong interest rate (for example an interest rate increase from 5.0 per cent to 6.0 per cent) which occurs due to the SBV (the central bank) tightening of monetary policy. The direct initial effect of a shock in Vietnamese dong interest rate on itself is shown in Figure 4.2(e). The impacts of monetary contraction on output, prices, Vietnamese dong monetary aggregate, foreign currency deposits and domestic US dollar interest rate over a 40-quarter horizon are illustrated in Figure 4.2(a), 4.2 (b), 4.2 (c), 4.2 (d) and 4.2 (f) respectively. The continuous lines in the graph represent the responses of variables after the unexpected increase in Vietnamese dong

interest rate in period 1. The upper and lower dotted lines represent the plus and minus two standard error bands of the impulse responses.

Figure 4.2 **Impulse responses to a shock in the Vietnamese dong interest rate**

Figure 4.2 (a) Output

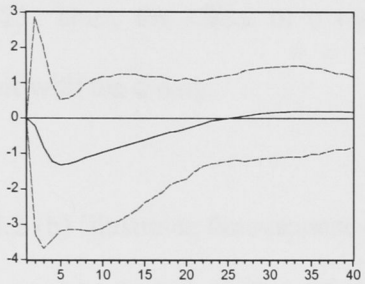


Figure 4.2 (b) Prices

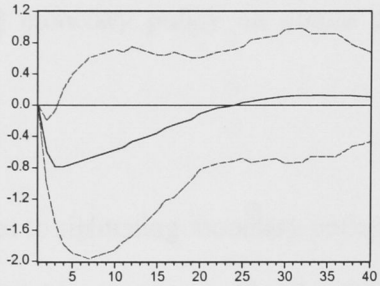


Figure 4.2 (c) VND monetary aggregate

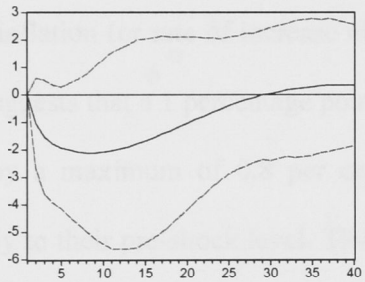


Figure 4.2 (d) Foreign currency deposits

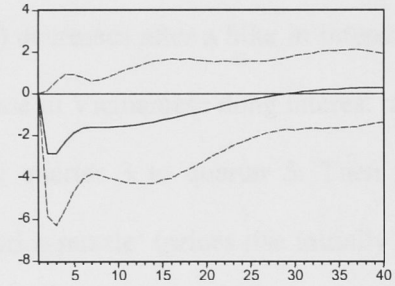


Figure 4.2 (e) VND interest rate

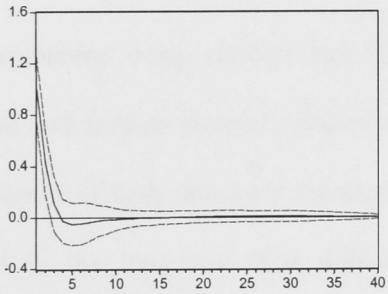
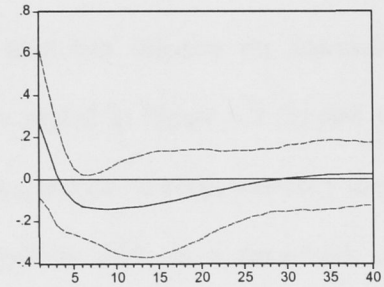


Figure 4.2 (f) USD interest rate



Note: The vertical axes in Figure 4.2 (a), 4.2 (b), 4.2 (c) and 4.2 (d) are in per cent, and in Figure 4.2 (e) and 4.2 (f) are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

Figure 4.2 (a) indicates the effect of Vietnamese dong interest rate shock on output. Due to the shock to interest rate being able to influence output in the next period, in period 1 output does not change. The influence of interest rate shock on output is strongest in the fourth quarter to seventh quarter after the shock (around 1.2 per cent below the base line). However, after that output starts to rise gradually to its pre-shock level from quarter 22 to quarter 25. Thus, the effect of a tightening monetary policy on output seems to be consistent with the theory.

Figure 4.2 (b) illustrates the response of prices to tightening monetary policy carried out by the central bank. Due to the ordering of variables in the recursive VAR model prices are not affected by the shock in interest rate in period 1. Similar to the movement of output, inflation (or rate of increase of prices) decreases after a hike in interest rate. The result suggests that a 1 percentage point increase in Vietnamese dong interest rate reduces prices by a maximum of 0.8 per cent from quarter 3 to quarter 5. Then prices rise gradually to their pre-shock level. Thus the 'price puzzle' (prices rise initially after a rise in the interest rate) seems not to appear in this model.

The Vietnamese dong interest rate shock also has impacts on domestic monetary aggregate and foreign currency deposits since period 2. Figure 4.2 (c) and 4.2 (d) show the responses of both domestic monetary aggregate and foreign currency deposits are as expected in the long run. The tightening policy leads to a maximum reduction in Vietnamese dong monetary aggregate of around 2 per cent from quarter 8^{th} to 10^{th}. The rise in interest rate for the Vietnamese dong might initially induce the public to a change

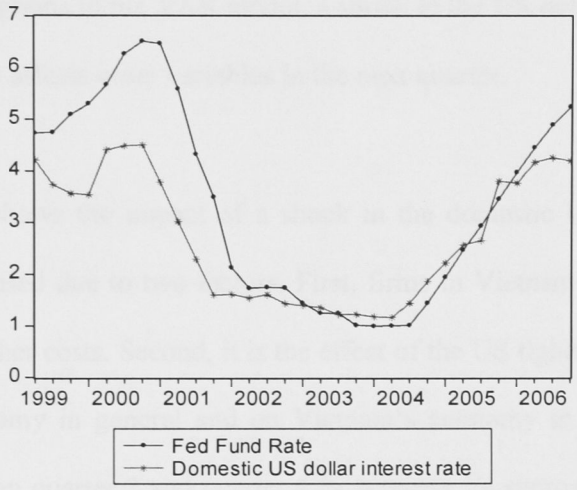
of approximately 3 per cent of their holdings of foreign currency deposits into Vietnamese dong deposits between quarters 2 and 4. Expecting this substitution, commercial banks would need to increase their domestic US dollar rate to maintain their funding in foreign currencies in the short term. The contemporaneous relationship between the Vietnamese dong interest rate and the domestic US dollar rate in the recursive assumptions explains the increase in the domestic US dollar rate at the same period that a shock to the Vietnamese dong interest rate occurs. However, the magnitude of increase in the domestic US dollar interest rate (0.25 percentage point) is lower than the magnitude of the shock to the Vietnamese dong interest rate (1 percentage point) but Vietnamese dong interest rate converges to its pre-shock level faster than US dollar interest rate does. In the long term, because of the slowdown in the economy, banks could reduce their US dollar interest rate. In general, the responses of most variables are as expected.

4.4.4.2 Impulse responses to a domestic US dollar interest rate shock

Figure 4.3 shows the movements of the domestic US dollar rate and the Federal Fund Rate in the research period 1999-2006. The central bank of Vietnam could influence the domestic US dollar rate by changing the reserve requirements or imposing the interest rate ceiling regarding foreign currency deposits made by legal entities. There were large differences between domestic US dollar interest rate and Federal Fund Rate in the period 1999-2001 as the central bank in Vietnam attempted to limit the conversion from Vietnamese dong into US dollar deposits in the economy in that period (SBV, 2000).

However, in the period 2002-06 the movement in the domestic US dollar rate generally follows the movements of the Federal Fund Rate.

Figure 4.3 **Movements of Federal Fund Rate and domestic US dollar interest rate**



Note: The vertical axis is in percentage point.

Source: Author's calculations.

Figure 4.4 shows the responses of all variables in the model to a one-time shock in the domestic US dollar interest rate (a rise of 1 percentage point). There are two reasons that could lead to the increase in the domestic US dollar interest rate. First, it may occur due to the US Federal Reserve tightening its monetary policy. Second, the central bank in Vietnam may raise the required reserve applied to foreign currency deposits in the banking system to keep the parity between Vietnamese dong interest rate and the domestic US dollar rate in order to limit the dollarization in the banking system and the fluctuations of exchange rate[34].

[34] Details on the movements of required reserve ratios for Vietnam dong and foreign currency deposits are presented in Chapter 3 (Section 3.3).

Because the figures in Figure 4.4 show the responses of all variables in the model to an increase in domestic US dollar interest rates which might also reflect the tightening conditions in the US economy and in the international markets, the responses of all variables should be similar to a contraction in domestic monetary policy. Due to the recursive assumptions in the VAR model, a shock to the US dollar interest rate occurring in quarter 1 only affects other variables in the next quarter.

Figure 4.4 (a) shows the impact of a shock in the domestic US dollar rate on output. Output is decreased due to two factors. First, firms in Vietnam which have loans in US dollars have higher costs. Second, it is the effect of the US tightening monetary policy on the world economy in general and on Vietnam's economy in particular. The effect is strongest between quarter 2 and quarter 4 (a decrease by approximately 2 per cent) after the increase in the domestic US dollar interest rate. Thus the impact of a shock in US dollar interest rate on output is faster and larger than in the case of Vietnamese dong interest rate shock. Thereafter, output increases and return to its pre-shock level from quarter 28 to quarter 30.

The responses of foreign currency deposits (Figure 4.4 (d)), domestic monetary aggregates (Figure 4.4(c)) and Vietnamese dong interest rates (Figure 4.4(e)) are generally as expected. The higher US dollar rate induces the public to transfer their holdings of Vietnamese dong into foreign currency deposits. The volume of foreign currency deposits increases by a maximum of 4 per cent between quarter 2 and quarter 4.

Figure 4.4 **Impulse responses to a shock in the domestic US dollar interest rate**

(a rise of 1 percentage point)

Figure 4.4 (a) Output

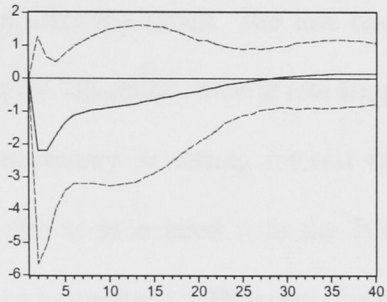


Figure 4.4 (b) Prices

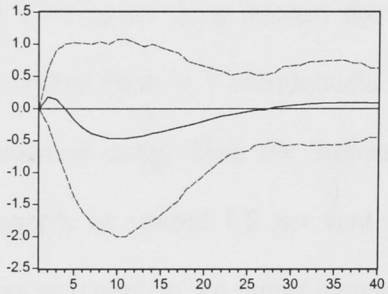


Figure 4.4 (c) VND monetary aggregate

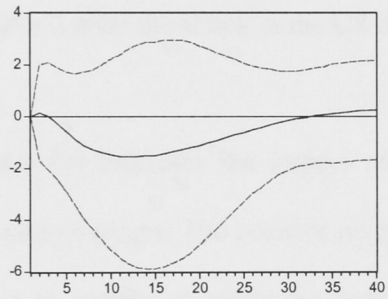


Figure 4.4 (d) Foreign currency deposits

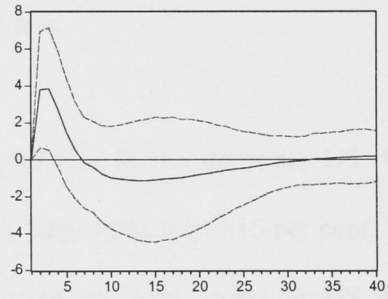


Figure 4.4 (e) VND interest rate

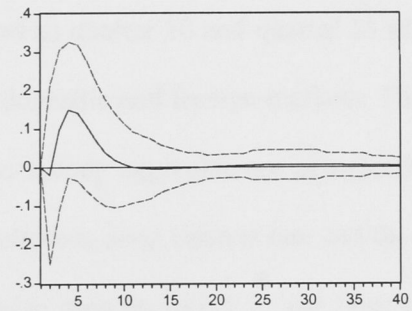
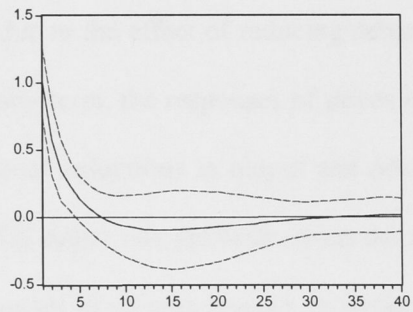


Figure 4.4 (f) USD interest rate



Note: The vertical axes in Figure 4.4 (a), 4.4 (b), 4.4 (c) and 4.4 (d) are in per cent, and in Figure 4.4 (e) and 4.4 (f) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

Commercial banks also need to adjust the interest rate for Vietnamese dong to retain their deposits in the domestic currency. The interest rate for Vietnamese dong is lower initially and then induced to a maximum increase of 0.15 percentage point between quarter 3 and quarter 6 after the shock. The low response of the Vietnamese dong interest rate to a shock in the US dollar interest rate suggests that the central bank in Vietnam could have certain autonomy in setting interest rates for Vietnamese dong. Then the increase in interest rate is associated with the fall in money supply at around 1.8 per cent from quarter 10 to quarter 15. However, the model does not well explain the minor increase in domestic monetary aggregate and decrease in the Vietnamese dong interest rate in quarter 1 to quarter 3 after the shock in the US dollar interest rate.

Figure 4.4 (b) indicates the impact of an unexpected rise in the domestic US dollar interest rate on prices. The positive response of prices (approximately 0.15 per cent) from quarter 2 to quarter 4 might be caused by the increased firms' costs in US dollar borrowings. After that period, prices are persistently at around 0.5 percent under the base line between quarter 10 and quarter 15 as expected due to the effect of reducing demand in both domestic and foreign markets. Thus in the long-term, the responses of prices and domestic money aggregate are as expected. Because of reductions in output and prices, the Vietnamese dong interest rate and the domestic US dollar rate gradually decrease and converge to their pre-shock levels. Overall, the responses of all variables are as expected in the long term.

4.4.4.3 Impulse responses to a shock in the Vietnamese dong monetary aggregate

The graphs in Figure 4.5 show the responses of all variables in the model to an unexpected increase in the Vietnamese dong monetary aggregate (an increase of 1 per cent) over horizon of 40 quarters, which may reflect an expansion of money supply due to the SBV intervention in the foreign exchange market to maintain exchange rate target (SBV 2005, Camen 2006)[35]. This is show by the direct initial effect of the shock to the Vietnamese dong monetary aggregate itself in Figure 4.5 (c).

Due to the recursive contemporaneous relationships in the model, a shock in the Vietnamese dong monetary aggregate has immediate impacts on foreign currency aggregate, Vietnamese dong and domestic US dollar interest rates. Output and prices are affected only in the next period after the shock. Figure 4.5 (a) describes the response of output. It rises in period of quarter 2 to quarter 7 after the expansion of the money supply. After that it gradually decreases. Output decreases by a maximum of around 0.2 per cent of its pre-shock level between quarter 10 and quarter 20. In the long run, output converges to its baseline. Thus, in this model the effect of loosening monetary policy on stimulating output might be short term.

[35] There is current debate on the impact of the SBV intervention in keeping pegged exchange rate on inflation, especially in the first half of 2007 the SBV has bought approximately US dollar 7 billions (Nguyen 2007).

Figure 4.5 **Impulse responses to a shock in the Vietnamese dong monetary aggregate** (a rise of 1 per cent)

Figure 4.5 (a) Output

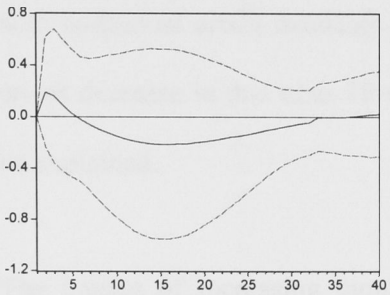


Figure 4.5 (b) Prices

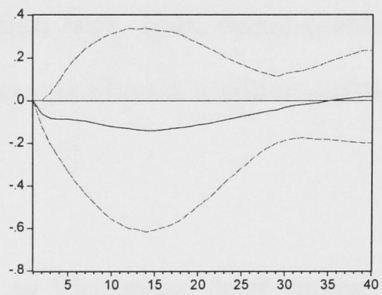


Figure 4.5 (c) VND monetary aggregate

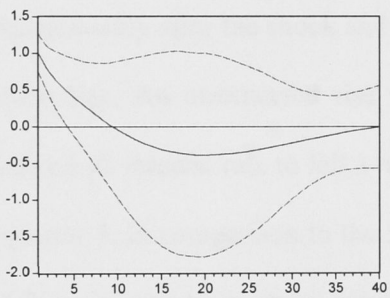


Figure 4.5 (d) Foreign currency deposits

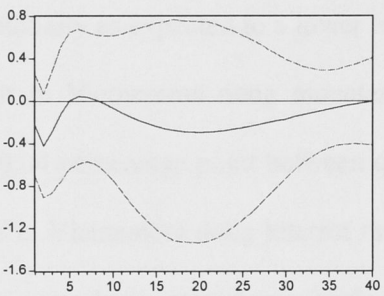


Figure 4.5 (e) VND interest rate

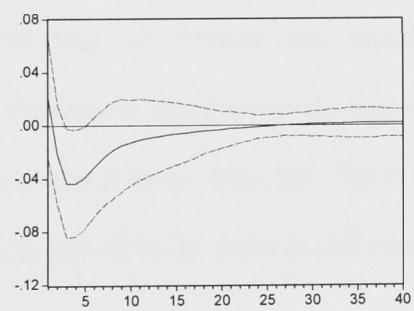
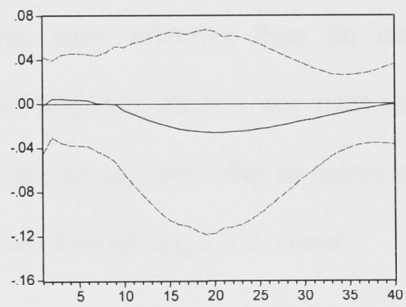


Figure 4.5 (f) USD interest rate



Note: The vertical axes in Figure 4.5 (a), 4.5(b), 4.5 (c) and 4.5 (d) are in per cent, and in Figure 4.5 (e) and 4.5 (f) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

The response of prices (Figure 4.5(b)) is not as expected in theory. Prices decrease persistently after increases in money supply. Prices are lower than the base line of approximately 0.1 per cent between quarter 10 and quarter 20. It could be the case that firms in Vietnam which depend heavily on bank credit could operate more efficiently with additional credit available at lower interest rates. Thus, output could increase and prices decrease in this case. However, the response of price is still a 'puzzle' needing to be explained.

The impact of increasing monetary supply to Vietnamese dong interest rate (Figure 4.5(e)) is not as expected in the short term. The Vietnamese dong interest rate increases immediately after the shock and decreases gradually as expected to a lower level than the base line. An unexpected rise of 1 per cent in Vietnamese dong monetary aggregate causes its interest rate to fall a maximum of 0.04 percentage point between quarter 3 and quarter 5. In comparison to the case of shock in Vietnamese dong interest rate (in Figure 4.2 (c) 1 percentage point increase in Vietnamese dong interest rate leads to 2 percent reduction in Vietnamese dong monetary aggregate) might suggest that for the SBV focusing on interest rate instrument maybe more effective than on manipulating Vietnamese dong monetary aggregate. In the long run, interest rate rises slowly to its pre-shock level. Thus the 'liquidity puzzle' (interest rate rise after an increase in money supply) seems to occur in this model in the short term although it is minor.

The response of foreign currency deposits is difficult to explain in this model. On the one hand, it is expected that the volume of foreign currency deposits in the banking system could increase due to a decrease in Vietnamese dong interest rate leading the public to

prefer US dollar deposits. On the other hand, the increase in output may lead the public to transfer a part of their foreign currency holdings into productive purposes and commercial banks have to increase the US dollar interest rate to retain foreign currency funds for their activities. However, the impact of increasing Vietnamese dong monetary supply on the domestic US dollar interest rate is minor. Overall, the responses of prices and Vietnamese dong interest rate to a shock in Vietnamese dong monetary supply is not well explained by the proposed recursive VAR model.

4.4.4.4 Forecast Variance Decomposition

While impulse response functions show the impacts of a shock to one endogenous variable on other variables in the VAR system, variance decomposition separates the variation of an endogenous variable into component shocks to the VAR system[36]. Table 4.4 presents variations in output and prices due to the innovations or shocks to itself and to other endogenous variables in the VAR system, for forecast horizons 1, 6, 12, 24 and 40 quarters ahead. The columns provide the percentage of the variation in each variable caused by different shocks, with each row adding up to 100.

Regarding the sources of output fluctuations, the estimation results show that monetary factors (both monetary aggregates and interest rates) explain around 10 per cent of output variations at a forecast horizon of 12 quarters and increase to around 14 per cent at a 24 quarter horizon. The domestic US dollar interest rate has a large impact on output movements in the short term but monetary aggregates in Vietnamese dong and foreign

[36] The derivation of variance decomposition is presented in Appendix 1.

currencies have an increasing role in explaining output fluctuations over the longer period.

Table 4.4 **Forecast variance decomposition of recursive VAR model**

Proportion of forecast error variance for	Forecast (quarters)	Shocks or innovations in					
	Period	Y	CPI	VND	FCD	RVND	RUSD
Output	1	100.0	0.0	0.0	0.0	0.0	0.0
	6	72.2	20.5	1.2	1.1	1.4	3.5
	12	47.9	41.9	2.1	3.0	2.0	3.0
	24	37.8	48.5	5.8	3.4	1.9	2.7
	40	37.1	48.6	6.2	3.3	1.9	2.7
	Period	Y	CPI	VND	FCD	RVND	RUSD
Prices	1	0.2	99.7	0.0	0.0	0.0	0.0
	6	1.2	86.6	3.6	3.9	4.3	0.2
	12	0.6	84.4	5.7	4.9	3.4	0.8
	24	0.6	80.5	10.2	4.7	2.8	1.0
	40	0.6	80.0	10.6	4.7	2.9	1.0

Note: 1. Sample period of the VAR estimation is Q2/1999-Q4/2006

2. The variance decomposition is forecast by using Choleski restrictions.

Source: Author's calculations.

In the case of price movements, the monetary factors contribute around 13 percent of the movement after 12 quarters and 17.1 per cent after 24 quarters. The monetary aggregate in Vietnamese dong has an increasing role in explaining price movements over the longer period. As output and price gradually converge to their pre-shock levels, the impacts of monetary factors on out put and inflation only change slightly between quarter 24 and quarter 40.

It is difficult to compare the results in Table 4.1 with those in Pham and Vo (2005), because different models are estimated and under different time periods. Pham and Vo (2005) find that broad money could explain around 15 to 17 per cent of output variation and a maximum of 1.2 per cent of price variation in 1 to 12 quarters after the shock in money supply.

4.4.5 Concluding remarks

The recursive VAR model proposed in this paper takes into account the conditions that are relevant to the monetary transmission processes in Vietnam such as dollarization in the economy and pegged exchange rate. The reactions of most variables in the model are consistent with the expectations of the impact of monetary policy in the economy. The "price puzzle" is not found in this model when considering the central bank tightening monetary policy by raising interest rates for Vietnamese dong. However, there is minor evidence of "liquidity puzzle" and the response of price level seems not be consistent with theory when considering the central bank's expansionary monetary policy of increasing monetary supply in Vietnamese dong. This may indicate that the restrictions imposed by recursive assumptions on the VAR model might not fully reflect the dynamics of the monetary transmission process in Vietnam. In the next section the non-recursive VAR models are investigated.

4.5 A non-recursive structural VAR model for monetary transmission in Vietnam (Model 2)

To solve the "puzzles" found in recursive structural VAR models, some empirical studies use the non-recursive structural VAR and additional variables that may contain indications of future inflation such as the US Federal Fund Rate and oil price. Such identification schemes, used by Sims and Zha (1995) on the US, Kim and Roubini (2000) on G-7 countries minus the US, Brischetto and Voss (1999) on Australia and Sodsrichai (2006) on Thailand, have achieved some reasonable results. The "puzzles" are not founds in their non-recursive models and the reaction of all variables such as output, prices, monetary aggregates, interest rate and exchange rate seem to follow the theory. However, Brischetto and Voss (1999) remark that the adding of oil price does not help to explain the response of all variables in the VAR model in the case of net energy exporting countries such as Australia, Canada or the UK in Kim and Roubini's (2000) study. Thus, Brischetto and Voss (1999) conclude that using oil price may be unnecessary for assessing monetary transmission in net - energy exporting countries.

Vietnam is also considered as a net energy exporting country in the period 1999-2006 (MOF 2007). Furthermore, Vietnam's domestic oil price is controlled and subsidized by the government[37]. Up to 2007 the Vietnamese government stipulates the price of petrol and fuel oil in the market. To keep the stipulated prices, the government can change the import taxes applied to petrol and fuel oil. If the reduction in taxes is not enough to counter the rise in import price, the Vietnam government compensates for the losses of

[37] Prices of other types of energy such as gas (for production of electricity and fertilizer), coal and electricity, are also under the management of the Vietnamese government.

oil trading enterprises resulting from selling oil products at predetermined prices (MOF 2007). For example, the subsidization provided by the Vietnam government to cover the losses of oil trading enterprises reached 8.700 trillion Vietnamese dong in 2006, equivalent to 0.9 percent of GDP (MOF 2007). Thus, the non-recursive VAR model for analyzing the monetary transmission process in Vietnam does not contain the oil price variable.

4.5.1 Restrictions of the non-recursive structural VAR model

In this part the paper will analyze the monetary transmission process in Vietnam by using a non-recursive structure as described in Table 4.5. The identification proposed in Table 4.5 follows Kim and Roubini (2000) and Brischetto and Voss (1999) in the sense that there are simultaneous relationships between monetary aggregates and interest rates in their VAR models.

Table 4.5 **Vietnam non-recursive identification of VAR system**

$\varepsilon_t = B_0 e_t$ can be written as:

$$
\begin{array}{c|c|c|ccccccc|c|c}
 & & & & & & & & & & & \\
1 & \varepsilon_Y & & b_{11} & & & & & & & & e_Y \\
2 & \varepsilon_{CPI} & & b_{21} & b_{22} & & & & & & & e_{CPI} \\
3 & \varepsilon_{VND} & = & b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & & & & e_{VND} \\
4 & \varepsilon_{FCD} & & b_{41} & b_{42} & b_{43} & b_{44} & 0 & b_{46} & & & e_{FCD} \\
5 & \varepsilon_{RVND} & & 0 & b_{52} & b_{53} & 0 & b_{55} & & & & e_{RVND} \\
6 & \varepsilon_{RUSD} & & 0 & 0 & b_{63} & b_{64} & b_{65} & b_{66} & & & e_{RUSD}
\end{array}
$$

Note: Coefficients on the main diagonal of matrix B_0 are 1.

Source: Author's calculations.

The ordering of variables represents the assumptions about the dynamic structure of Vietnam's economy. Similar to the recursive VAR structural model, in the non-recursive VAR model output and prices are not affected contemporaneously by changes in financial variables. The price level is assumed to react to changes in output immediately.

In this model, the monetary aggregate equations (line 3 and line 4 in Table 4.5) are based on money demand. The demand for Vietnamese dong monetary aggregate is assumed to depend contemporaneously on output, price level, the current demand for foreign currency and the interest rate of Vietnamese dong. The demand for foreign currency depends on output, price level, the current demand for Vietnamese dong monetary aggregate and domestic interest rate of the US dollar.

The central bank is assumed to set interest rates after observing the current conditions in financial markets and the price level. Output is assumed not to be available at the time monetary policy is set due to information delay. Because the central bank in Vietnam could influence the domestic US dollar interest rate and the level of foreign currency deposits in the banking system by adjusting the reserve requirement ratio in favor of Vietnamese dong, the Vietnamese dong interest rate is assumed not to depend contemporaneously on the level of foreign currency deposits (line 5). The domestic US dollar interest rate is assumed not to depend on the current condition of price level because the main objective of the central bank in setting the domestic US dollar interest rate is to limit the degree of dollarization in the economy (SBV 2000). Furthermore, if we consider shocks to the domestic US dollar interest rate which derive from the action of

the US Federal Reserve, it would be reasonable to have this assumption. However, the domestic US dollar rate is assumed to be affected by shocks on all financial variables in the model (line 6).

It should be noted that the assumed restrictions mentioned here are only applied to the first period when a shock to an endogenous variable in the VAR system occurs. In the second period and thereafter, all variables freely interact with each other.

4.5.2 Estimation results and interpretation

Table 4.6 **Identifying test of non-recursive VAR model**

$$\begin{vmatrix} \varepsilon_Y \\ \varepsilon_{CPI} \\ \varepsilon_{VND} \\ \varepsilon_{FCD} \\ \varepsilon_{RVND} \\ \varepsilon_{RUSD} \end{vmatrix} = \begin{vmatrix} 1 & & & & & \\ 0.0058 & 1 & & & & \\ 17287 & -237196 & 1 & -65950 & -108.7 & \\ 0.343 & 12.827 & 8.88 & 1 & 0 & -0.057 \\ 0 & 22.513 & -1.65 & 0 & 1 & 0 \\ 0 & 0 & 2.22 & 2.80 & -0.269 & 1 \end{vmatrix} \begin{vmatrix} e_Y \\ e_{CPI} \\ e_{VND} \\ e_{FCD} \\ e_{RVND} \\ e_{RUSD} \end{vmatrix}$$

Log likelihood = 291.59 LR test for over-identification: Chi-square (1) = 0.142 Probability = 0.7066

Source: Author's calculations.

The VAR system is over-identified (only 14 restrictions). The convergence of the restriction matrix and the result of the test for over-identification suggest that the restrictions are valid. The impulse responses of all variables in this section are derived from structural decomposition of matrix B_0 in Table 4.6.

4.5.2.1 Impulse responses to a shock in the Vietnamese dong interest rate

Figure 13 shows the responses of all variables in the VAR model to a one-time unexpected increase of 1 percentage point in the Vietnamese dong interest rate which occurs due to the central bank tightening its monetary policy. The continuous green lines in the graphs represent the point estimate responses of variables in the model. The dotted red lines represent the plus or minus two standard error bands for the variables.

It is noted that the standard error bands are very wide and in most cases encompass zero (the base line) for the whole of the response. This happens because of the contemporaneous interdependence between monetary aggregates and interest rates. Other studies on monetary transmission using non-recursive assumptions also observe similar large standard error bands[38]. However, the focus of the analysis should be on the point estimates rather than the standard error bands themselves as these provide the best guide to this type of model's responses (Brischetto and Voss 1999).

[38] In assessing the impulse responses Brischetto and Voss's (1999) study on Australia uses 90 per cent confidence intervals, Sodsrichai's (2006) study on Thailand uses two standard error bands, and in most cases the impulse responses are statistically insignificant. Kim and Roubini (2000) study on G7 countries minus the US use one standard error bands so the impulse responses are statistically significant in some cases.

Figure 4.6 **Impulse responses to an unexpected increase in the Vietnamese dong interest rate** (a rise of 1 percentage point)

Figure 4.6 (a) Output

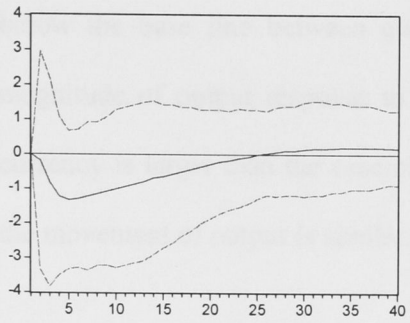


Figure 4.6 (b) Prices

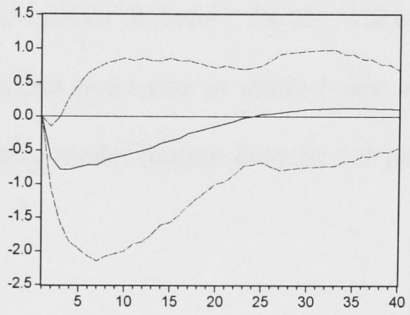


Figure 4.6 (c) VND monetary aggregate

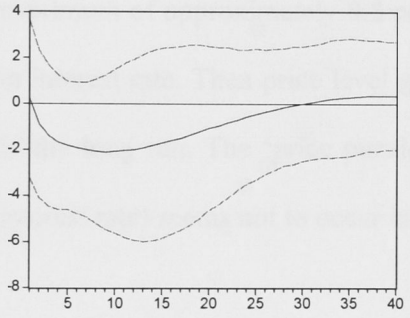


Figure 4.6 (d) Foreign currency deposits

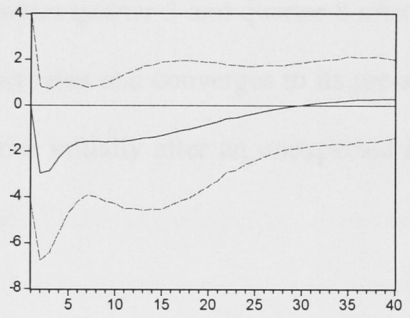


Figure 4.6 (e) VND interest rate

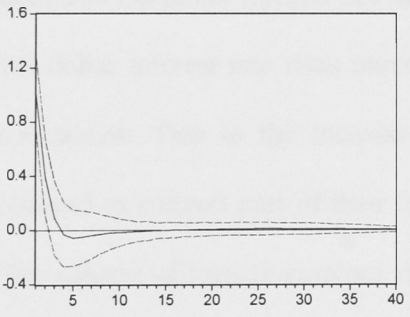
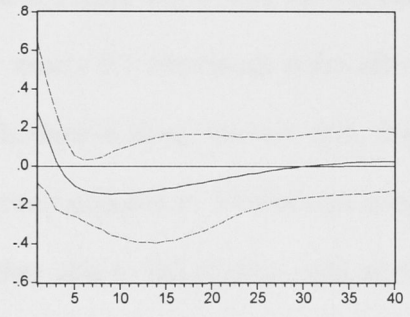


Figure 4.6 (f) USD interest rate



Note: The vertical axes in Figure 4.6 (a), 4.6 (b), 4.6 (c) and 4.6 (d) are in per cent, and in Figure 4.6 (e) and 4.6 (f) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

Figure 4.6 (a) indicates the impact of a rise in Vietnamese dong interest rate on output. The reaction of output in general is as expected. Overall, a 1 percentage point increase in the Vietnam dong interest rate causes domestic output to fall approximately 1.4 per cent below the base line between quarter 4 and quarter 8 before slowly dissipating. The magnitude of output response to a 1 percentage point rise in interest rate of domestic currency is larger than the case of the recursive model (output drop by 1.2 per cent) but the movement of output is similar.

The responses of prices as presented in Figure 4.6 (b) are as expected. Prices fall to a maximum of approximately 0.8 per cent between quarter 3 and quarter 8 after the shock in interest rate. Then price level gradually increases and converges to its pre-shock level in the long run. The 'price puzzle' (prices rise initially after an unexpected increase in interest rate) seems not to occur in the model.

The impacts of a Vietnamese dong interest rate increase on foreign currency deposits and domestic US dollar interest rate are described in Figure 4.6 (d) and 4.6 (f). The domestic US dollar interest rate rises immediately by nearly 0.3 percentage point after monetary contraction. Due to the increase of the Vietnamese dong interest rate, the public is induced to convert part of their foreign currency deposits to Vietnamese dong deposits. The volume of foreign currency deposits is then able to fall slightly right after the shock and reaches a maximum of 3 per cent from quarter 2 to quarter 4. It is possible that commercial banks may have to raise the domestic US dollar rate to maintain foreign currency funds for their operations.

The conversion into Vietnamese dong might prompt the central bank to buy US dollars and sell Vietnamese dong to keep the pegged exchange rate. Thus the Vietnamese dong monetary aggregate (Figure 4.6 (c)) rises slightly after the shock in the Vietnamese dong interest rate. However, in the long run, the Vietnamese dong monetary aggregate decreases as expected by approximately 2 percent. Due to the reduction in output, interest rates in both the US dollar and Vietnamese dong gradually decrease and converge to baseline in the long run. Overall, the responses of all variables in the model are well defined.

4.5.2.2 Impulse responses to a shock in the domestic US dollar interest rate

The graphs in Figure 4.7 show the reactions of all variables to a one-time unexpected increase of 1 percentage point in the domestic US dollar rate. In the recursive model, a shock to the US dollar interest rate only exerts its impact on monetary aggregates and the Vietnamese dong interest rate in the next period after the shock. However, in this model, the non-recursive assumptions allow the Vietnamese dong interest rate as well as Vietnamese dong and foreign currency monetary aggregates to be affected in the same period that the shock in the US dollar rate occurs. The interactions between monetary variables in the first period explain the large standard error bands in the non-recursive model in comparison with the recursive model[39].

[39] Brischestto and Voss (1999) offer similar arguments to explain the wide standard error bands in the impulse responses in their non-recursive VAR models.

Figure 4.7 **Impulse responses to an unexpected increase of domestic US dollar interest rate**

Figure 4.7 (a) Output

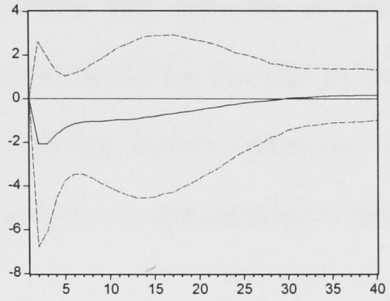


Figure 4.7 (b) Prices

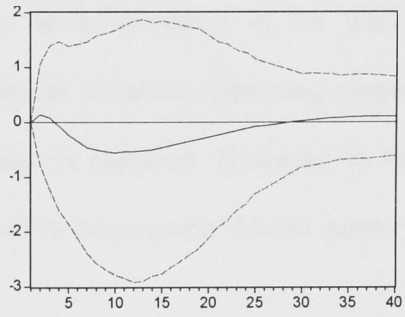


Figure 4.7 (c) VND monetary aggregate

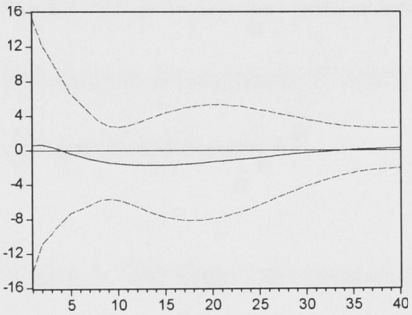


Figure 4.7 (d) Foreign currency deposits

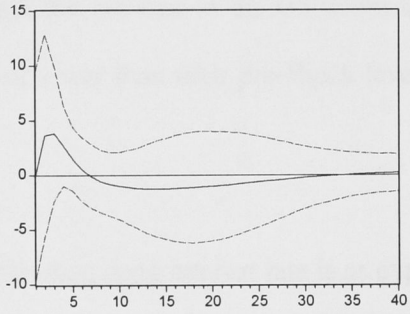


Figure 4.7 (e) VND interest rate

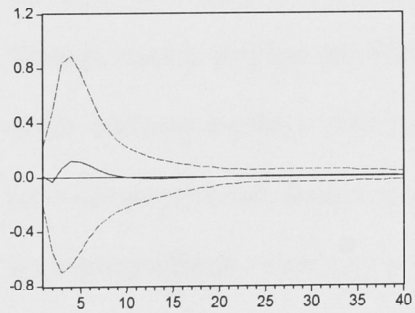
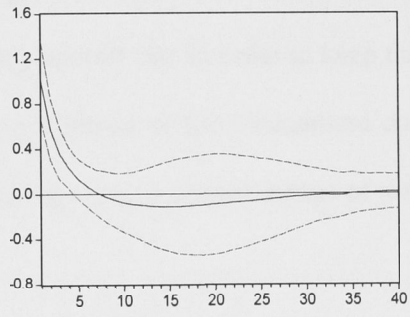


Figure 4.7 (f) USD interest rate



Note: The vertical axes in Figure 4.7 (a), 4.7 (b), 4.7 (c) and 4.7 (d) are in per cent, and in Figure 4.7 (e) and 4.7 (f) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

The responses of all variables in this non-recursive VAR model appear to be well explained. Figure 4.7 (a) indicates the response of domestic output after the shock in the US dollar interest rate. Output is only affected by the shock in the domestic US dollar interest rate since the second period. Due to a slowdown in the world economy (represented by the US) or the central bank in Vietnam tightening monetary policy regarding foreign currencies, output decreases as expected. However, in the long run output rises and converge to its pre-shock level between quarter 26 and quarter 30.

The response of prices (Figure 4.7(b)) is similar to the impact we observe in the recursive model. Price levels are persistently lower after the increase in the US dollar interest rate and drop to a maximum of nearly 0.5 per cent lower than their pre-shock levels between quarter 10 and quarter 13.

Figure 4.7 (e) shows the response of the Vietnamese dong interest rate is as expected. The rise in the domestic US dollar interest rate may induce the public to increase their holdings of foreign currency deposits (Figure 4.7(d)). Thus, commercial banks in Vietnam need to increase the Vietnamese dong interest rate in order to keep their funding in the domestic currency. The delay and low response of the Vietnamese dong interest rate indicates that the central bank in Vietnam may have a certain degree of independence in deciding domestic monetary policy.

The effect on Vietnamese dong money aggregate (Figure 4.7 (c)) is not as well specified as in the case of the recursive VAR model. It increases approximately 0.8 per cent after the shock in the US interest rate and then gradually decreases. It is possible that the

substantial deregulation Vietnam's financial sector has experienced in this period has affected the relationship between interest rates and monetary aggregates. This evidence can be found in the previous literature on other countries. Brischetto and Voss (1999) in their non-recursive VAR model on Australia also observe this effect. They explain that the difficulties may be associated with modeling money demand arising from the structural changes in the research period. To support that argument, Valadkhani *et al* (2005) find that the timing of structural breaks for various monetary aggregates and interest rates in Australia coincide with important policy changes during the period of financial deregulation starting in the 1980s. Kim and Roubini (2000) in their study on G7 countries minus the US also observe similar responses of monetary aggregate and domestic interest rate in some countries.

The reductions in output and prices may lead to a decrease in interest rates of Vietnamese dong and foreign currencies. As a result, in the long run, the reactions of all variables after the shock in the US dollar interest rate are as expected.

4.5.2.3 Impulse responses to a shock in the Vietnamese dong monetary aggregate

The graphs in Figure 4.8 show the responses of all variables in the VAR model to a one per cent increase in Vietnamese dong money supply which might occur due to the SBV intervention in the foreign exchange market to maintain exchange rate target (SBV 2005, Camen 2006). The initial direct impact of the unexpected rise in money supply on itself is described in Figure 4.8 (c). As has been explained previously, large standard error bands of impulse responses are the result of non-recursive assumptions.

Figure 4.8 **Impulse responses to an unexpected increase in the Vietnamese dong money aggregate**

Figure 4.8 (a) Output

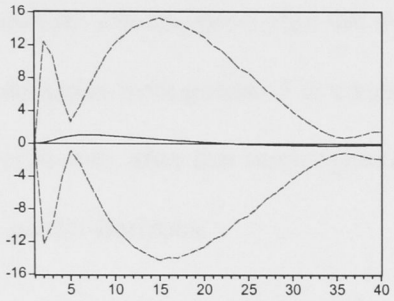


Figure 4.8(b) Prices

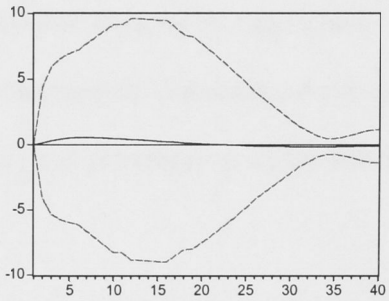


Figure 4.8 (c) VND monetary aggregate

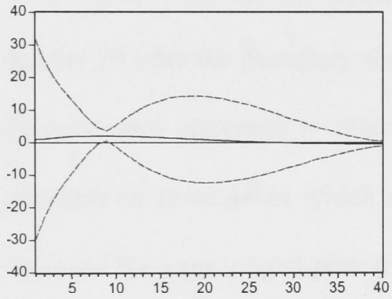


Figure 4.8 (d) Foreign currency deposits

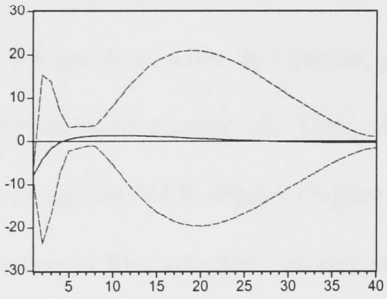


Figure 4.8 (e) VND interest rate

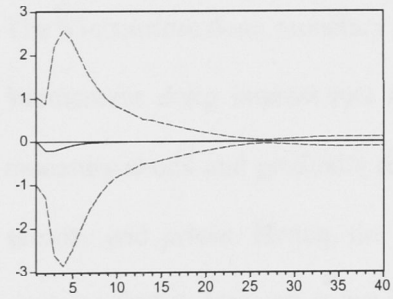
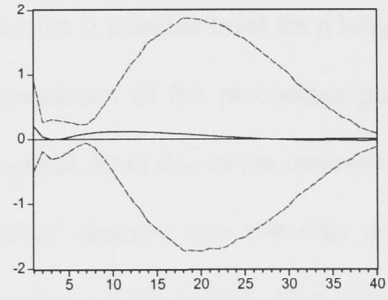


Figure 4.8 (f) USD interest rate



Note: The vertical axes in Figure 4.8 (a), 4.8 (b), 4.8 (c) and 4.8 (d) are in per cent, and in Figure 4.8 (e) and 4.8 (f) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

The responses of all variables in the non-recursive VAR model are as expected. The loosening of monetary policy leads to more persistent increase in output (Figure 4.8(a)) than in the case of recursive VAR model (in Figure 4.5(a) output only increase from quarter 2 to quarter 6 after the shock in Vietnamese dong money aggregate). The effect is strongest from quarter 5 to quarter 9 after the increase in Vietnamese dong money supply. However, after that output gradually decreases and converges to its pre-shock level in 25 quarter-horizons.

Prices (Figure 4.8(b)) are also higher for a prolonged period after the increase in Vietnamese dong money supply. The impact on prices is strongest from quarter 5 to quarter 10 after the monetary shock at nearly 0.8 per cent. After that period, prices slowly decrease and converge to their pre-shock levels since quarter 20. Thus, the abnormal response of price level which exists in the recursive VAR model (Figure 15b: Prices decrease for a prolonged period after the increase in Vietnam dong money supply) is not found in the non-recursive VAR model.

The Vietnamese dong monetary aggregate remains at a higher level for a long period. The Vietnamese dong interest rate decreases a maximum of 0.2 percentage point after the monetary shock and gradually rises to its pre-shock level due to the increase in economic activity and prices. Hence, the 'liquidity puzzle' (interest rate rise after an increase in money supply) does not occur in the non-recursive VAR model. Also the impact of an unexpected increase of Vietnamese dong money supply on its interest rate is larger than in the case of recursive VAR model (in Figure 4.5 (e) Vietnamese dong interest rate drop by 0.04 percentage point).

The explanations for responses of foreign currency deposits and domestic US dollar interest rates are similar to the case in the recursive VAR model. The increase of economic activity might induce the public to withdraw part of their foreign currency deposits for consumption and production purposes. Thus, banks have to raise the domestic US dollar interest rate by around 0.2 percentage point to maintain foreign currency funds for their activities. Overall, the responses of all variables in the model appear to be well explained. Regarding the expansion of monetary policy by increasing Vietnamese dong money supply, there is no evidence of a "liquidity puzzle" and the response of prices is well defined in the non-recursive VAR model.

4.5.2.4 Forecast variance decomposition

Table 4.7 presents variations in output and prices due to the innovations or shocks to themselves and to other endogenous variables in the VAR system, for forecast horizons 1, 6, 12 and 24 quarters ahead. The columns provide the percentage of the variation in each variable caused by different shocks, with each row adding up to 100.

Regarding the sources of output fluctuations, the estimation results show that monetary factors (both monetary aggregates and interest rates) explain around 10 per cent of output variations at forecast horizon of 12 quarters and 14 per cent at forecast horizon of 24 quarters. Output movements are more closely related to the fluctuations in prices than monetary factors.

Table 4.7 **Forecast variance decomposition of the non-recursive VAR model**

Proportion of forecast error variance for	Forecast (quarters)	Shocks or innovations in					
	Period	Output	Prices	VND	FCD	RVND	RUSD
Output	1	100.0	0.0	0.0	0.0	0.0	0.0
	6	72.4	20.2	1.3	1.4	1.4	3.2
	12	48.0	41.6	2.7	2.6	2.0	3.0
	18	39.9	47.5	2.7	4.9	2.0	3.0
	24	37.9	48.2	2.6	6.4	1.9	2.9
	40	37.2	48.3	2.6	6.8	2.0	2.9
	Period	Output	Prices	VND	FCD	RVND	RUSD
Prices	1	0.3	99.7	0.0	0.0	0.0	0.0
	6	1.4	86.5	2.8	4.6	4.4	0.3
	12	0.7	84.3	3.3	6.7	3.1	1.2
	18	0.6	82.1	3.0	9.7	3.0	1.5
	24	0.6	80.4	2.9	11.4	3.0	1.5
	40	0.6	80.0	3.0	11.8	3.0	1.5

Note: 1. Sample period of the VAR estimation is Q2/1999-Q4/2006

2. The variance decomposition is forecast by applying restrictions on the relationships between structural innovations and estimated errors stated in Table 4.6.

Source: Author's calculation

In the case of price movements the monetary factors contribute around 14 per cent of the movement after 12 quarters and 19 per cent after 24 quarters. Regarding monetary factors, interest rates of both the Vietnamese dong and US dollar have a crucial role in explaining price fluctuations. Unlike the recursive VAR model, in this non-recursive VAR model, foreign currency deposits plays a larger role than Vietnamese dong monetary aggregate in explaining the variations in output and prices. Overall, compared to the recursive VAR model, the impact of monetary factors in the non-recursive model on output is similar but their effects on prices are higher.

4.5.4 Robustness check (Model 3)

The non-recursive VAR model is estimated with GDP data for period 2001-6. The lag length of the model is one quarter. The diagnostic tests of all equations generally provide satisfactory outcomes. The results show the errors of all equations are normally distributed, have no serial correlation, no heteroskedasticity and no functional form mis-specification. The result of over-identification test confirms that the restrictions of the non-recursive VAR model are valid[40].

In this section the study focuses mainly on the impulse responses of output and prices only. Figure 4.9 shows the reactions of output and price level in the non-recursive VAR model to a one percentage point unexpected rise in the Vietnamese dong interest rate over a horizon of 40 quarters.

Figure 4.9 **Impulse responses to a shock in the Vietnamese dong interest rate**

Figure 4.9 (a) Output

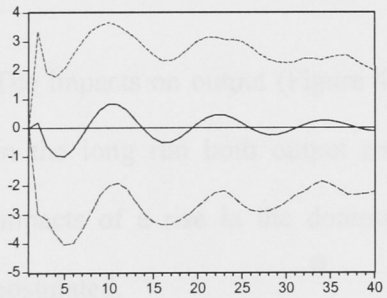
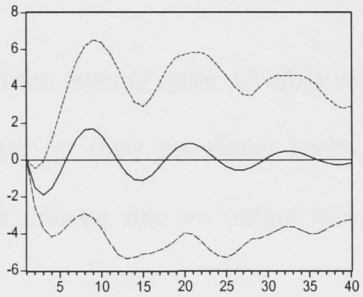


Figure 4.9 (b) Prices



Note: The vertical axes in Figure 4.9 (a) and 4.9 (b) are per cent. The horizontal axes are in quarters.

Source: Author's calculations.

[40] Details of all tests of model 3 are presented in Appendix A.3.

Figure 4.9 (a) indicates the response of output. In the first quarter after the shock, the initial slight surge in output seems to be contrary to theory. Bernanke and Mihov (1995) give the explanation that this short-term output surge may reflect inventory accumulation occurring at the beginning of monetary contraction due to contract commitments. Other empirical studies using a non-recursive VAR model such as Sodsrichai (2006) on Thailand, and Kim and Roubini (2000) on G7 countries minus the US, also observe short-term surges in output after increases in domestic interest rates.

The response of prices shows that there is no evidence of a price puzzle. Price level is lower between quarter 1 and quarter 6 after a tightening monetary policy. However, the impacts of an interest rate shock lead to output and price level fluctuate around the baseline before convergence to their pre-shock levels.

Figure 4.10 shows the responses of output and price level to an unexpected increase of one percentage point in the domestic US dollar interest rate.

The impacts on output (Figure 4.10(a)) and price level (Figure 4.10(b)) are as expected. In the long run both output and prices return to their pre-shock levels. Overall, the impacts of a rise in the domestic US dollar interest rate on output and prices are as postulated.

Figure 4.10 **Impulse responses to a shock in the domestic US dollar interest rate**

Figure 4.10 (a) Output

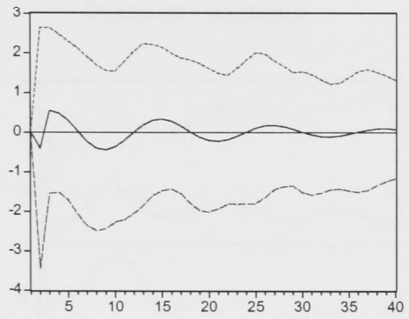
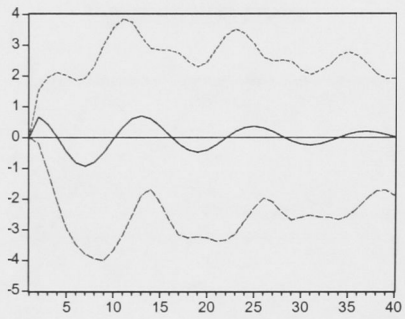


Figure 4.10 (b) Prices



Note: The vertical axes in Figure 4.10 (a) and 4.10 (b) are in per cent. The horizontal axes are in quarters.

Source: Author's calculations.

Figure 4.11 shows the responses of output and price level to a one per cent unexpected increase in domestic monetary aggregate. Output increases to a maximum of approximately 0.2 per cent between quarter 7 and quarter 10 after the loosening of monetary policy. Meanwhile, price level rises by 0.4 per cent between quarter 6 and quarter 8. In the long run output and prices gradually decrease. There is no evidence of a 'price puzzle' in the model.

The impacts of a loosening of monetary policy on output and prices in this non-recursive model are similar to the previous non-recursive model (Figure 4.8 (a) and 4.8 (b)) but at smaller magnitudes. Overall, the results of the VAR model show that the non-recursive assumptions proposed in this study are valid.

Figure 4.11 **Impulse responses to a shock in the Vietnamese dong monetary aggregate**

Figure 4.11(a) Output

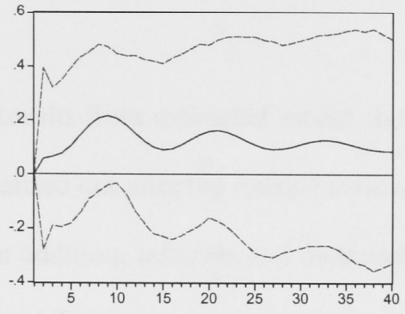
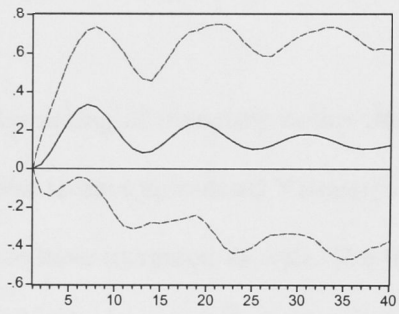


Figure 4.11 (b) Prices



Note: The vertical axes in Figure 4.11 (a) and 4.11 (b) are in per cent. The horizontal axes are in quarters.

Source: Author's calculations.

4.5.5 Concluding remarks

In this paper both recursive and non-recursive VAR models are investigated in order to analyze the monetary transmission processes in Vietnam's economy. Unlike past research on Vietnam, our model allows a differentiation between domestic monetary aggregate and foreign currency aggregate as well as domestic currency interest rate and US dollar interest rate in order to analyze the impact of monetary policy in a dollarized economy.

The non-recursive VAR model seems to offer a better explanation than the recursive VAR model. The non-recursive VAR model is able to better explain the dynamic response of Vietnam's economy in the case of changing domestic monetary policy. The 'liquidity puzzle' and 'price puzzle' are not found in the model. The absence of these puzzles is indirect evidence that the model appears to be suitable for analyzing monetary

transmission processes in the case of Vietnam in the period 1999-2006. The robustness of the results is checked by re-estimating using alternative variable and time periods. However, the proposed non-recursive VAR model still suffers from minor anomalies that may be caused by the financial liberalization process occurring in this period.

Results from estimated model show that the loosening of monetary policy that the SBV carried out after the Asian Financial Crisis seems to have stimulated Vietnam's economy. In addition, inflation and dollarisation appear to have increased as well. The finding that the Vietnamese dong interest rate increased by 0.2 percentage point in response to an unexpected increase of 1 percentage point in the domestic US dollar interest rate suggests that the central bank in Vietnam is still able to maintain independent monetary policy. Unlike past research, this study find the impact of monetary policy in the period 1999-2006 is consistent with theory.

CHAPTER 5 THE BANK LENDING CHANNEL OF MONETARY TRANSMISSION IN VIETNAM

5.1 Conditions for the existence of a bank lending channel in Vietnam

As mentioned in Chapter 2 the credit channel operates through two main channels - the balance sheet channel and the bank lending channel. Due to the limitation of data available the analysis in this chapter focuses on the bank lending channel in Vietnam. Literature on conditions for the existence of the bank lending channel focuses on two assumptions (Kashyap and Stein 1993). First, is the dependence of certain groups of borrowers on bank lending. Second, is the power of the central bank through its instruments to influence the loan amounts supplied by banking sector. The existence of these two assumptions is determined by the structure of the financial market and its institutional regulation in each country. This section will analyze these assumptions in the case of Vietnam.

Regarding the existence of certain groups of borrowers that heavily rely on bank loans as an external financial source, the prevailing situation in Vietnam is that the groups are not only small firms but also large firms (WB 2002). There are several reasons for this phenomenon.

First, although the stock market has developed rapidly in recent years, its role as a direct funding source for firms is still limited. At the end of 2006, the value of the stock market

is equivalent of 17 per cent of GDP (Tu 2007)[41] whereas the value of total credit in the economy is nearly 70 per cent of GDP. Furthermore, bank credit is also a major source of funds to be invested in the stock market. Thus, new regulations by the SBV concerning stock related lending has slowed down the stock market (Lee *et al* 2007).

Second, the common feature of some Vietnamese firms is that the owner's capital is limited and many firms need to raise external funds for their operations. Table 14 shows the source of funds in different type of enterprises in the period 1999-2002. All types of enterprises depend on external debts but the State-owned enterprises are most dependent. Therefore, accessing to bank credit is essential for enterprises in Vietnam.

Table 5.1 **Capital resources of enterprises in Vietnam, 1999-2002,** (trillion VND)

	1999		2000		2001		2002	
	Debts	Owner's capital	Debts	Owner's capital	Debts	Owner's capital	Debts	Owner's capital
SOEs	344	250	524	223	603	218	642	252
Non SOEs	48	35	70	43	97	64	142	95
FDI enterprises	118	100	131	108	146	121	170	138

Note: Data are end of the year numbers.

Source: Author's calculations (from General Statistic Office industrial complete survey 2000-2003).

[41] The value of new funds invested in the IPOs, which relates directly to funding of firms, might be much lower than the market value of the stock market. The foreign indirect investment reaches US dollar 1 billion in 2006, equivalent of approximately 1.4 per cent of Vietnam's GDP (Ha 2007).

Lastly, the "lock-in effect" between borrowers and banks in Vietnam is also an important factor. The classification of borrowers has only been carried out recently by the Credit Information Center and focuses on certain groups of customers. Thus, for many firms switching costs might be high and maintaining long-term relationships with banks is an advantage. In conclusion, in the case of Vietnam, the first assumption that certain groups of borrowers depend on bank loans is satisfied.

As far as the second assumption relating to the effectiveness of central bank instruments is concerned, Kashyap and Stein (1993) suggest some micro aspects that would break down the relationship between monetary policy and the amount of loans supplied as follows:

1. The considerable role of the non-banking sector in providing loan to customer.
2. The amount of bank bonds as a buffer against reserve shocks.
3. The banks' ability to attain non-reserve funds.
4. Existence of regulatory standards and constraints.

Each of these aspects will be examined to justify whether the second assumptions is satisfied in the case of Vietnam. Regarding the first aspect, a rising concern is the magnitude that non-banking institutions could become an alternative source of funds for borrowers. As these institutions usually are not subject to reserve requirements, there is no direct effect on them when the central bank tightens its monetary policy.

In Vietnam the main non-banking institutions are insurance companies and the Vietnam Development Bank (VDB) – a state owned policy bank. However, only certain types of

customers could access loans from the VDB and the total of outstanding loans of VDB as at the end of 2006 is VND 96 trillions, which is equivalent to approximately 14 per cent of that of the banking system (VDB 2007). The re-investments by insurance companies to the economy reach the highest volume of VND 34 trillions in 2006, which are equivalent to nearly 5 per cent of total bank lending volume in 2006 (MOF 2007). Given the short history of operations by insurance companies and regulations on investing premiums, insurance companies are not major lenders in the current period. Thus, firms still find it difficult to switch to alternative sources of finance in Vietnam.

The second aspect is that banks could keep alternative assets (bonds and bills) rather than loans. When facing a tightening monetary policy, banks could sell the alternative assets to generate funds so they do not need to cut down their lending. Therefore, a tightening monetary policy affects bank lending only when banks keep a small ratio of their assets in bonds. Table 15 shows the asset structure of credit institutions in Vietnam in the period 2001-6.

Table 5.2 **Asset structures of credit institutions in Vietnam, 2001-2006** (per cent)

	2001	2002	2003	2004	2005	2006
Reserves	6.2	5.9	7.4	6	5.9	7.4
Treasury bills, notes and bonds	3.4	5.1	8.2	3.2	7.7	8.3
Foreign assets	26.7	20.8	12.3	11.1	10.1	11.4
Credit to customers	63.6	68.2	72.1	79.5	76.2	72.8

Source: Author's calculations.

Table 5.2 shows that the main part of credit institution assets is credit to customers. The ratio of liquid assets, including Treasury note and government bonds, in total assets is small. As the liquidity of government bonds is quite low, therefore, banks usually keep them to maturity. Hence, the bank's ability to generate funds from liquid assets might be limited.

Third aspect that needs to be considered is bank's ability to attract non-reserve requirement funds. If banks are in a position of easily being able to switch to other sources of funds, like certificates of deposits (CDs), to avoid the reserve requirement, the bank lending channel might not be effective. In general, commercial banks could raise non-reserve funds in the forms of CDs, equity and offshore borrowing. The two later forms are not easily available in Vietnam. The Vietnamese government and SBV issue restrictive regulations on offshore borrowing and selling bank equity to foreign residents. In regarding to the issuance of CDs, under the current regulation on reserve requirements, only CDs with terms of more than 24 months are exempt from reserve requirements. Furthermore, commercial banks have to obtain SBV approval for issuing CDs with terms of more than 12 months. As a result, in the case of monetary tightening it is difficult for banks to avoid cutting down loans by increasing CDs issuance.

The last aspect is the implementation of regulatory standards and constraints. One example for this is the regulation of the Capital Adequacy Ratio (CAR). Kashyap and Stein (1993) argue that if capital requirements imposed on loans are high, banks could choose to hold more bonds or other low-risk assets rather than to provide new loans that

subject to high capital requirements (due to high risk). Such linkages would weaken the impact of monetary policy through the bank lending channel because banks could avoid cutting down lending by adjusting their low-risk assets in the case of monetary contraction. In Vietnam's case, only some banks have achieved the required CAR of 8 per cent (VET 2006). As Table 5.2 shows the ratio of bank bond holdings is small, so the bank lending channel is still effective.

In summary, there is no evidence that financial structure and institutional regulations might break down the link between monetary policy and lending activity of the banking system in Vietnam. The next section will review different approaches in analyzing the bank lending channel and explore a VAR model of bank lending in the case of Vietnam.

5.2 Relevant approaches on the bank lending channel

There are some different approaches to investigating the bank lending channel in the literature. A standard model is suggested by Bernanke and Blinder (1988). In their model, the bank lending market is added into three markets (money, bonds, goods) of the traditional IS/LM model. The supply of loans depends negatively on the interest rate on bonds and positively on the interest rate on loans. The demand for loans depends negatively on the interest rate on loans and positively on the interest rate on bonds. Tightening monetary policy implies an increase in the spread between the interest on loans and interest of bonds in this model. In the model the spread between the interest rate on loans and interest rate of bonds is considered as the supply side of credit.

For the existence of a bank lending channel, Miron *et al* (1995) agree that there should be a widening spread between loan and bond rates during a tight monetary period. However, they add that after changes in monetary policy there should be evidence of changes in the ratio of loans to the total of loans and commercial papers. In other words, the responses of different types of bank asset are not equal following the monetary policy change.

Carrasquilla (1998), Sirivedhin (1998) and Kim (1999) use this approach in recursive VAR models to assess the response of bank asset to monetary policy shocks. They find that both loans and bonds are reduced following monetary contractions but response of bond is quicker than that of loans. Thus, there is evidence of the existence of a bank lending channel. Holtermoller (2005) also uses this approach with a non-recursive VAR model to analyze the credit channel in Germany. He also finds strong evidence of the effectiveness and relevance of the bank lending channel.

Another approach to examine the bank lending channel is proposed by Bayoumi and Morsink (2001), and Disyatat and Vongsinsirikul (2006). Specifically, the VAR technique is performed with the following steps. First, a basic VAR model is estimated to capture relationships between variables of interest on monetary transmission mechanism, namely output, price index and policy variables. Second, a VAR model assessing the interest channel is estimated. Then the credit variable will be added to the basic VAR model. Finally, the responses of output and prices in two latter models will be compared. Bayoumi and Morsink (2001) find that the bank lending channel is very important for non-financial private sector in Japan. Disyatat and Vongsinsirikul (2006) also show bank

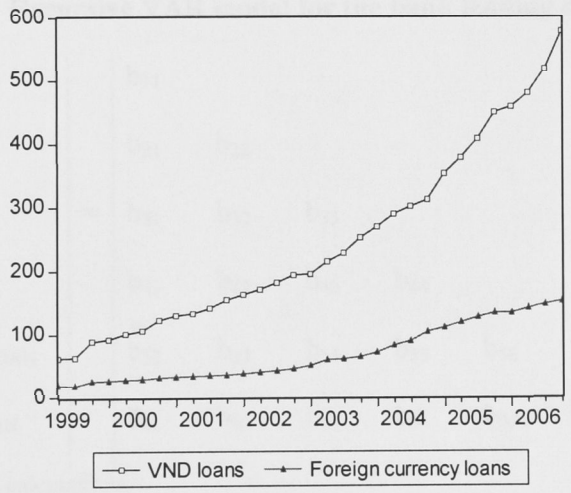
lending channel enhance the impact of changes in monetary policy on output and inflation in Thailand.

5.3 Recursive VAR Model for the bank lending channel (Model 4)

5.3.1 Model specification

Figure 5.1 shows the volumes of bank loans in Vietnamese dong and foreign currencies in the period 1999-2006. The largest increases occurred in 1999 when the SBV carried out a loosening monetary policy to stimulate the economy. The differences in growth rates of bank loans in VND and foreign currencies suggest that they might have different impacts on output and price level. Camen (2006) notes that the stable exchange rate and low level of US dollar interest rate also leads to higher growth rate of lending in foreign currency than that of Vietnamese dong in period 2003-2004.

Figure 5.1 **Volumes of foreign currency and Vietnamese dong loans, 1999-2006**



Note: The left hand side axis is in trillion VND.

Source: Author's calculations.

In this section a recursive VAR model of seven variables with same approach as Bayoumi and Morsink (2001), and Disyatat and Vongsinsirikul (2006) is used to analyze the bank lending channel in Vietnam[42]. The output (Y), price index (CPI), nominal exchange rate (EX), Vietnamese dong interest rate (RVND) and US dollar interest rate (RUSD) variables are the same as in Chapter 4. Two new variables are volumes of Vietnamese dong credit (VNDLOAN) and foreign currency credit (FCLOAN). Data of Vietnam dong credit and foreign currency credit are from IFS database and State Bank of Vietnam. All variables are used in logarithmic form except for the interest rate. The analysis is estimated using quarterly data from 1999.2 to 2006.4 giving a total of 31 observations. All variables are checked and adjusted for seasonality.

Table 5.3 shows the recursive VAR identification for assessing bank lending channel in Vietnam.

Table 5.3 **Recursive VAR model for the bank lending channel in Vietnam**

$$
\begin{array}{|c|c|c|c|c|c|c|c|c|}
\hline
1 & \varepsilon_{Y} & = & b_{11} & & & & & e_{Y} \\
2 & \varepsilon_{CPI} & & b_{21} & b_{22} & & & & e_{CPI} \\
3 & \varepsilon_{RVND} & & b_{31} & b_{32} & b_{33} & & & e_{RVND} \\
4 & \varepsilon_{RUSD} & & b_{41} & b_{42} & b_{43} & b_{44} & & e_{RUSD} \\
5 & \varepsilon_{VNDLOAN} & & b_{52} & b_{53} & b_{54} & b_{55} & b_{56} & e_{VNDLOAN} \\
6 & \varepsilon_{FCLOAN} & & b_{61} & b_{62} & b_{63} & b_{64} & b_{65} \quad b_{66} & e_{FCLOAN} \\
\hline
\end{array}
$$

Source: Author's calculations.

[42] The approach proposed by Bernanke and Blinder (1998) is not investigated due to the limitation on data and the recent development of the bond market in Vietnam.

In our VAR model, the ordering of variables is: Output (Y), prices (CPI), Vietnamese dong interest rate (RVND), domestic US dollar interest rate, credit in Vietnamese dong (VNDLOAN) and credit in foreign currencies (FCLOAN). The ordering of the variables reflects implicit assumptions on the dynamic structure of the bank lending channel. Output is not affected contemporaneously by shocks to prices, interest rates, supply and demand of bank credit. Prices are influenced contemporaneously by changes in output.

Interest rates are affected by changes in prices and in output contemporaneously. Bank credit is affected contemporaneously by changes in other variables in the model. Because the lending interest rates on both Vietnamese dong and foreign currency loans have been gradually deregulated since August 2000 the interest rates used in this model are short-term deposits rates, which have been deregulated since late 1996[43]. Therefore, these rates may better reflect the changes in the SBV's monetary policy and conditions in the money market.

Figure 5.1 shows that volumes of bank loans in foreign currencies were around 20 to 25 per cent of the total bank loans in the period 1999-2006. As the SBV also applied regulations to limit the use of foreign currency loans, therefore, VNDLOAN variable comes before FCLOAN variable in the model.

The lag length of the VAR model is two quarters, based on several criteria. The diagnostic tests of all equations generally provide satisfactory outcomes. The results

[43] Details of the process of deregulation of interest rates in Vietnam are presented in Chapter 3, section 3.2.

show the errors of all equations are normally distributed, have no serial correlation, no heteroskedasticity and no functional form mis-specification[44].

The stability test of the VAR model shows that the VAR is stable. Thus the impulse responses are valid. The VAR model is estimated with recursive assumptions (Choleski decomposition).

5.3.2 Estimation results and interpretation

The study in this section analyzes the impulse responses of variables in the VAR system to one-time shocks to Vietnamese dong interest rate, domestic US dollar interest rate, Vietnamese dong monetary aggregate and foreign currency loans. After that, forecast variance decomposition is examined.

5.3.2.1 Impulse responses to a shock in the Vietnam dong interest rate

The graphs in Figure 5.2 show the responses of all variables in the system to a one-time unexpected increase in the Vietnamese dong interest rate of one percentage point in a horizon of 45 quarters. Figure 5.2 (c) indicates the response of Vietnamese dong interest rate to an unexpected rise in itself. After the shock, the Vietnamese dong interest rate decreases and stabilizes from the quarter 10.

Following the monetary contraction, Vietnamese dong loans are reduced by nearly 2 per cent (Figure 5.2 (e)). Between quarter 5 and quarter 12 after the shocks, volume of VND bank lending is decreased by 5 per cent.

[44] Details of the specific tests of each equation are presented in the Appendix A.4.

Figure 5.2 **Impulse responses to a shock in the Vietnamese dong interest rate**

Figure 5.2(a) Output

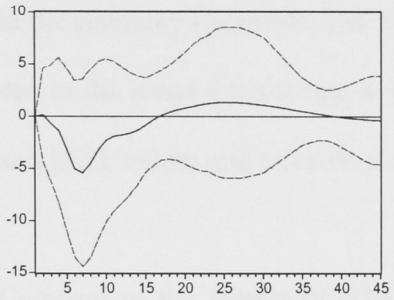


Figure 5.2 (b) Prices

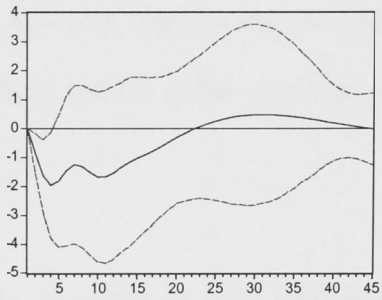


Figure 5.2 (c) VND interest rate

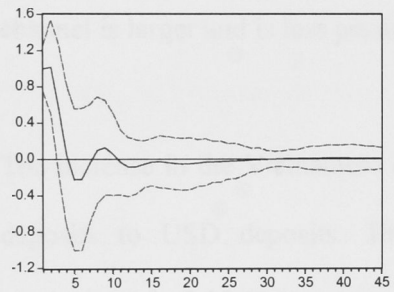


Figure 5.2 (d) USD interest rate

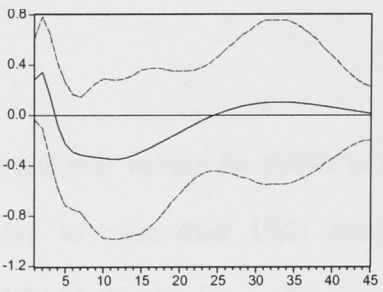


Figure 5.2 (e) VND loans

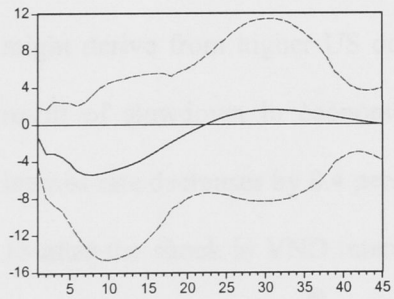
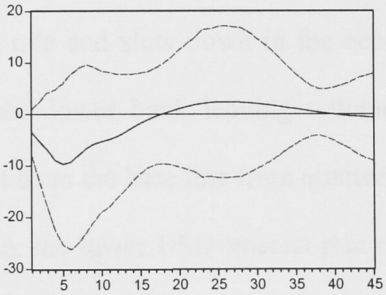


Figure 5.2 (f) Foreign currency loans



Note: The vertical axes in Figure 5.2 (a), 5.2 (b), 5.2 (e) and 5.2 (f) are in per cent, and in Figure 5.2 (c) and 5.2 (d) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

The reduction in bank lending affects output and price level until quarter 15 to quarter 20 after the shocks (Figure 5.2 (a) and 5.2 (b)). Output decreases from the third quarter after the shock in interest rate. The initial surge of output might reflect contract commitments in the economy (Bernanke and Mihov 1995). However, since quarter 20 after the shock - due to the lower interest rate in Vietnamese dong and US dollar – bank lending in VND and USD, output and price level all increase.

Compare to the impact of VND interest rate on output in VAR models presented in Chapter 4 (Figure 4.2 (a) and 4.6(a)), the impact on output and prices in the bank lending channel is larger and is less persistent.

The increase in the Vietnamese dong interest rate may induce the public to prefer VND deposits to USD deposits. Thus banks need to raise their USD interest rate of approximately 0.35 percentage point (Figure 5.2 (d)). The lending in foreign currencies is lower, as expected (Figure 5.2 (f)). The drop of nearly 10 per cent in foreign bank lending might derive from higher US dollar lending rate and slow down in the economy. As a result of slowdown in economic activity and lower bank lending volume, the USD interest rate decreases by 0.4 percentage point from the base line from quarter 5 to quarter 15 after the shock in VND interest rate. Then, the lower USD interest rate could induce higher foreign currency borrowing and increases in output and price level. The response of USD interest rate is similar to its reactions in the VAR models in Chapter 4. Overall, the responses of all variables in the model are well explained.

5.3.2.2 Impulse responses to a shock in the domestic US dollar interest rate

Figure 5.3 describes the reactions of all variables to an unexpected increase in the domestic USD interest rate by 1 percentage point. The responses of output (Figure 5.3(a)) and prices (Figure 5.3(b)) are similar for the case of an unexpected rise in VND interest rate. Due to the recursive assumption of the VAR model, the domestic USD interest rate, VND bank loans and foreign currency bank loans are affected at the same time that the shock occurs.

The increase in the domestic USD interest rate induces an increase in the VND interest rate in the short run of approximately 0.4 percentage point. Facing the higher cost of borrowing in USD loans, firms may prefer to borrow in VND loans (5.3(e)). Thus firms may choose to increase borrowing in VND in the short term. Furthermore, due to the sticky nature of loan agreements, the volume of Vietnamese dong loans could also increase from quarter 1 to quarter 3 after the unexpected rise in the domestic USD interest rate. From quarter 5 to quarter 15 after the shock, bank lending in foreign currency is decreased by nearly 10 per cent (Figure 5.3(f)). As banks are induced to raise the VND interest rate, between quarters 4 and 15 the volume of VND loans drops by nearly 6 per cent. As a result of higher interest rates and reduction in bank loans, the economy slows down from quarter 5 to quarter 10 after the shock. From quarter 25 to quarter 40 after the shock, the lower interest rates, especially in VND, might induce an increase of bank loans and lead to higher output and prices. Thus, the responses of output and prices are as expected. However, the magnitude of the impact of a shock in USD interest on output and price in this model is bigger than in the VAR model presented in Chapter 4 (Figure 4.4

(a), (b) and 4.7(a), (b)). In conclusion, the reactions of all variables are as projected in this case.

Figure 5.3 **Impulse responses to a shock in the domestic US dollar interest rate**

Figure 5.3 (a) Output

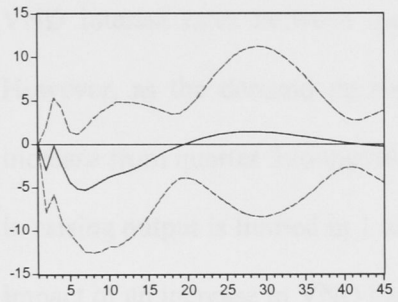


Figure 5.3 (b) Prices

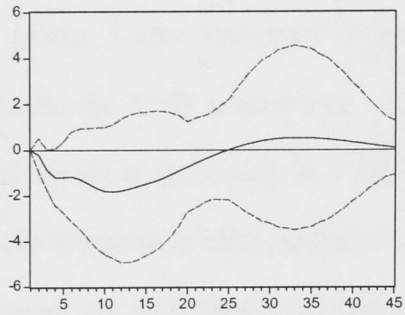


Figure 5.3 (c) VND interest rate

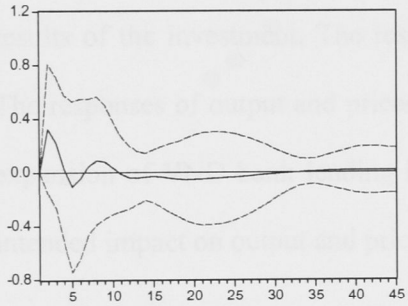


Figure 5.3 (d) USD interest rate

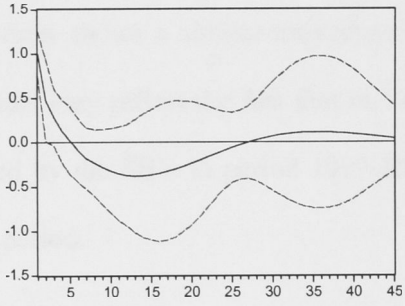


Figure 5.3 (e) VND loans

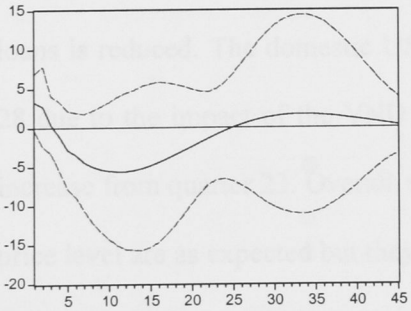
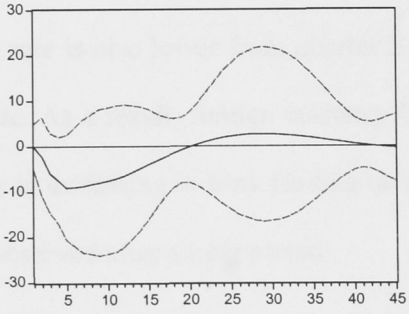


Figure 5.3 (f) Foreign currency loans



Note: The vertical axes in Figure 5.3 (a), 5.3 (b), 5.3 (e) and 5.3 (f) are in per cent, and in Figure 5.3 (c) and 5.3 (d) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

5.3.2.3 Impulse responses to a shock in Vietnamese dong bank loans

Figure 5.4 indicates the reactions of all variables in the model following an increase of 1 per cent in VND bank loans. The shock to bank loans might occur as the central bank loosens the regulatory lending standards and commercial banks also expand lending activities. The increase in VND bank lending is associated with a minor reduction in VND interest rates between quarter 2 and quarter 5 after the shock (Figure 5.4(c)). However, as the demand on bank loan expands; the VND interest rate is induced to increase from quarter 5 to quarter 8. The initial impact of an increase in VND bank loans in raising output is limited in 1 to 3 quarters after the shock in bank lending. The long-run impact of an increase in VND bank loans on output and price level is only presented from quarter 20 to quarter 40. This may reflect the long lag between investment by firms and results of the investment. The response of prices shows a similar movement to output. The responses of output and prices in the model may reflect the fact that in Vietnam the expansion of VND bank lending implemented by the SBV in period 1999-2000 has its intended impact on output and prices on later period.

As firms may choose to increase borrowing in VND, the volume of foreign currency bank loans is reduced. The domestic USD interest rate is also lower from quarter 5 to quarter 28 due to the impact of the VND interest rate. As a result, foreign currency bank loans increase from quarter 23. Overall, the impacts in increasing in bank lending on output and price level are as expected but they are only observed after a long period.

Figure 5.4 **Impulse responses to a shock in Vietnamese dong bank loans**

Figure 5.4 (a) Output

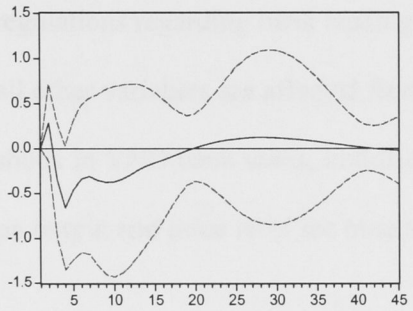


Figure 5.4 (b) Prices

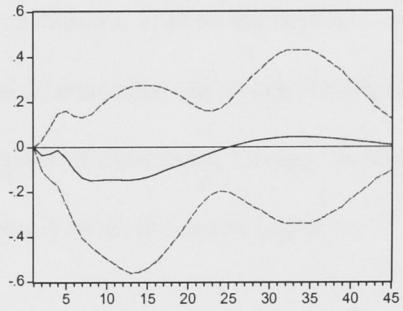


Figure 5.4 (c) VND interest rate

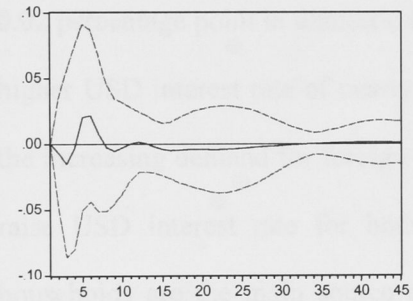


Figure 5.4 (d) USD interest rate

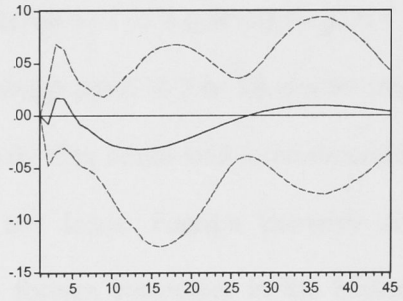


Figure 5.4 (e) VND loans

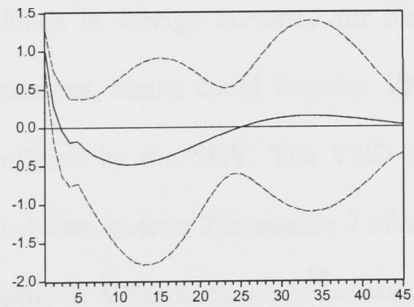
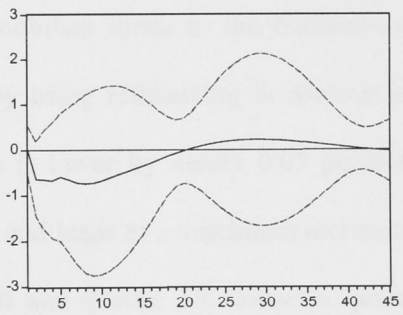


Figure 5.4 (f) Foreign currency loans



Note: The vertical axes in Figure 5.4 (a), 5.4 (b), 5.4 (e) and 5.4 (f) are in per cent, and in Figure 5.4 (c) and 5.4 (d) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

5.3.2.4 Impulse responses to a shock in foreign currency lending

Figure 5.5 shows the responses of all variables in the model to an unexpected rise of 1 per cent in foreign currency lending. This shock might occur as the central bank loosens the regulations regarding bank lending in foreign currencies. Due to the recursive assumption all other variables are affected from the second quarter after the shock. Unlike the case of shock in VND bank loans, in this case the impacts of increasing foreign currency lending on output and price level are observed immediately from the second quarter.

The increase of foreign currency loans by 1 per cent is associated with the decrease of 0.02 percentage point in domestic USD interest rate in 2 to 4 quarters (Figure 5.5(d)). The higher USD interest rate of nearly 0.05 percentage point in 5 to 20 quarter might reflect the increasing demand for foreign bank loans by firm could lead to commercial banks to raise USD interest rate for both deposits and loans. Foreign currency deposits by households are the main source of funds in foreign currencies in the banking system (SBV 2000). As foreign borrowing is restricted by regulations, the usual way to increase funds in foreign currency for banks is to mobilize funds in the domestic market. In contrast, banks could increase VND funds by using refinancing or discounting facility offered by the SBV. The VND interest rate is lower by nearly 0.05 percentage point between quarter 2 to quarter 7 after the shock and leads to a maximum increase of 0.5 per cent in VND bank loans between quarter 10 and quarter 15. Between quarter 20 and quarter 40 after the shock in bank lending in foreign currencies, output, price level and bank lending are all lower and stabilize around the base line. Overall, the responses of all variables in the model are as expected.

Figure 5.5 **Impulse responses to a shock in foreign currency bank loans**

Figure 5.5 (a) Output

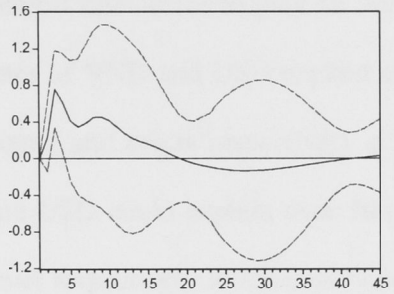


Figure 5.5 (b) Prices

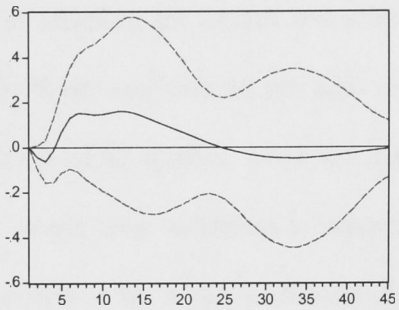
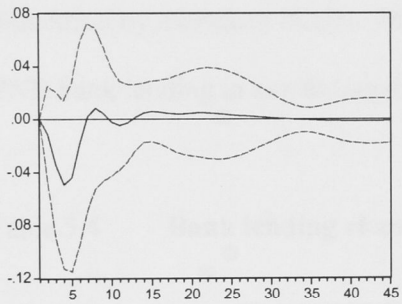


Figure 5.5 (c) VND interest rate



5.5 (d) USD interest rate

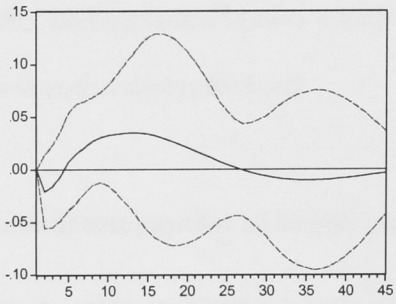


Figure 5.5 (e) VND loans

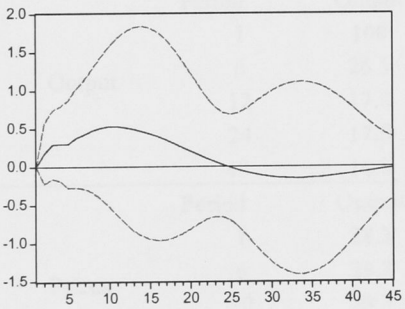
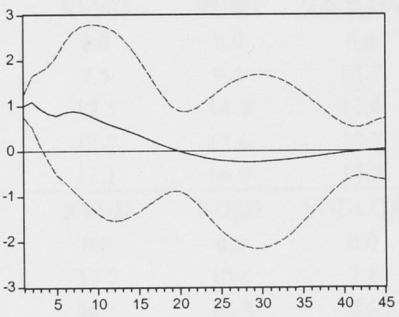


Figure 5.5 (f) Foreign currency loans



Note: The vertical axes in Figure 5.5 (a), 5.5 (b), 5.5 (e) and 5.5 (f) are in per cent, and in Figure 5.5 (c) and 5.5 (d) they are in percentage point. The horizontal axes are in quarters.

Source: Author's calculations.

5.3.2.5 Variance decomposition of VAR model for the bank lending channel

Table 15 shows the variance decomposition of output and prices. The bank credit and interest rate seems to play an important role in affecting the output and prices. Interest rates of VND and USD explain approximately 28 per cent and 40 per cent variations in output and prices respectively at forecast horizon of 12 quarter. Bank lending in VND and USD could explain over 50 per cent and 34 per cent variations in output and price level respectively at forecast horizon of 12 quarters. Price level is affected significantly by the shock to itself between quarter 1 and quarter 6. After that price level is heavily influenced by monetary factors. Foreign currency lending seems to have a larger role than VND bank lending in explaining the variations in output and price level.

Table 5.4 **Bank lending channel - Variance decomposition of output and prices**

Proportion of forecast error variance for	Forecast (quarters)	Shock in					
	Period	Output	Prices	RVND	RUSD	VNDLOAN	FCLOAN
Output	1	100	0.0	0.0	0.0	0.0	0.0
	6	26.3	3.3	7.5	9.4	13.7	39.8
	12	17.8	2.0	12.5	14.8	13.6	39.2
	24	17.0	2.2	12.7	15.6	13.7	38.7
	40	16.6	2.1	13.1	16.0	13.8	38.4
	Period	Output	Prices	RVND	RUSD	VNDLOAN	FCLOAN
Prices	1	28.3	71.6	0.0	0.0	0.0	0.0
	6	29.8	12.5	33.2	10.4	2.8	11.4
	12	20.3	5.2	24.6	15.9	9.6	24.3
	24	16.1	3.8	21.2	18.4	11.8	28.6
	40	16.0	3.6	21.2	18.5	11.8	28.8

Source: Author's calculations.

5.3.3 Robustness check (Model 5)

The model is re-estimated using the bank lending rates in Vietnam dong and US dollars in the period 1999-2006. Data of bank lending rates in Vietnam dong and US dollars are from IFS database and State Bank of Vietnam. The lag length of the VAR model is one quarters, based on several criteria. The diagnostic tests of all equations generally provide satisfactory outcomes. The results show the errors of all equations are normally distributed, have no serial correlation, no heteroskedasticity and no functional form mis-specification[45].

Figure 5.6 shows the responses of all variables in the model to an unexpected increase of 1 percentage point in the lending interest rate of Vietnamese dong. The shock in the VND lending interest rate causes output, price level and bank lending to fall between quarter 1 and quarter 15 or 20. However, the initial surge of output in Figure 5.6 (a) after the shock in the VND interest rate is more obvious than in Figure 5.2 (a). Besides, the declines in output, prices (Figure 5.6 (b)), VND bank loans (Figure 5.6 (e)) and Foreign currency banks loans (Figure 5.6 (d)) in this model are smaller than that of in Figure 5.2. In general, the reactions of all variables in this model are similar to responses in Figure 5.2.

[45] Details of all tests of each equation are presented in Appendix A.5.

Figure 5.6 **Impulse responses to an unexpected increase in the VND interest rate**

Figure 5.6 (a) Output

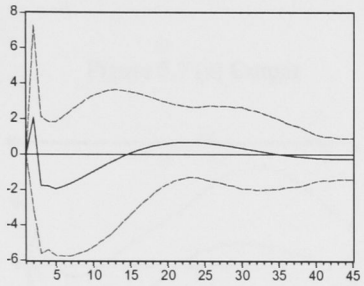


Figure 5.6 (b) Prices

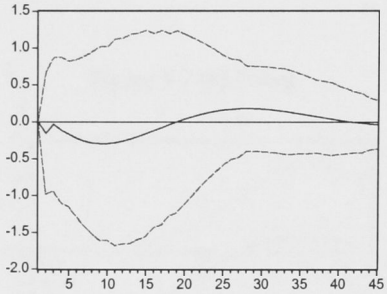


Figure 5.6 (c) VND interest rate

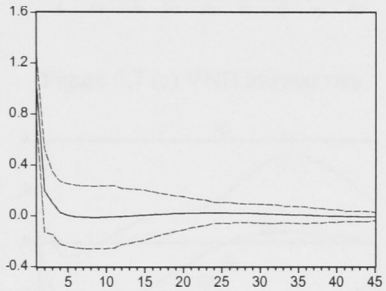


Figure 5.6(d) USD interest rate

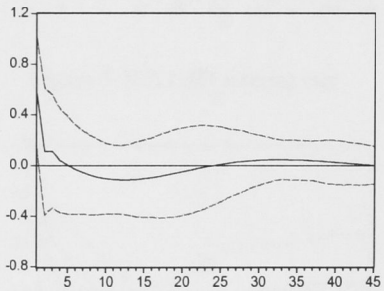


Figure 5.6 (e) VND loans

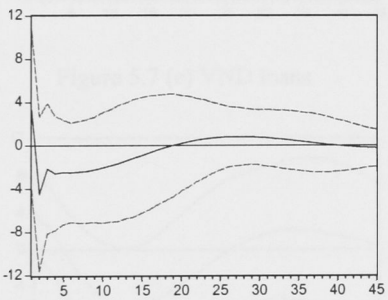
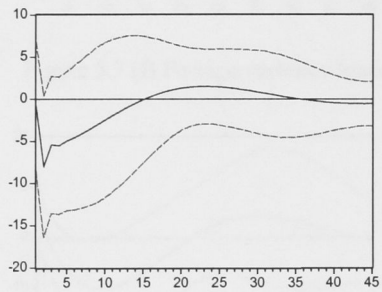


Figure 5.6 (f) Foreign currency loans



Notes: The vertical axes in Figure 5.6 (a), 5.6 (b), 5.6 (c) and 5.6 (f) are in per cent, and in Figure 5.6 (c) and 5.6 (d) are in percentage point. The horizontal axes are in quarter.

Source: Author's calculations.

Figure 5.7 describes the reactions of all variables in the VAR model to a shock in the US dollar lending interest rate of 1 percentage point.

Figure 5.7 **Impulse responses to an unexpected increase in the domestic US dollar interest rate**

Figure 5.7 (a) Output

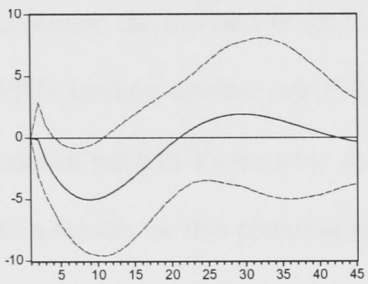


Figure 5.7 (b) Prices

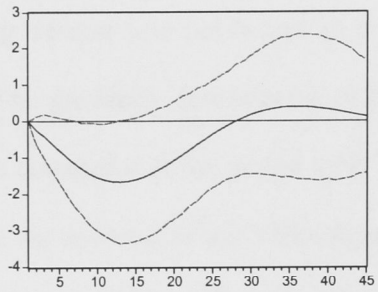


Figure 5.7 (c) VND interest rate

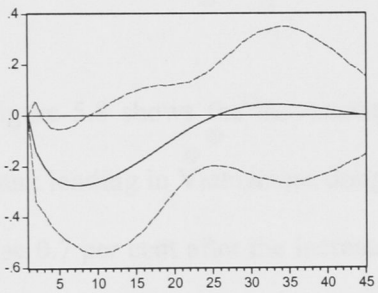


Figure 5.7(d) USD interest rate

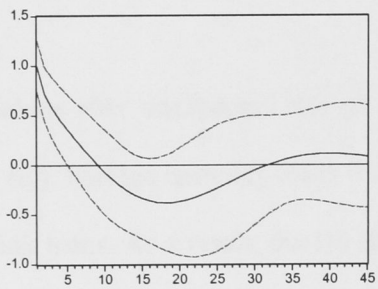


Figure 5.7 (e) VND loans

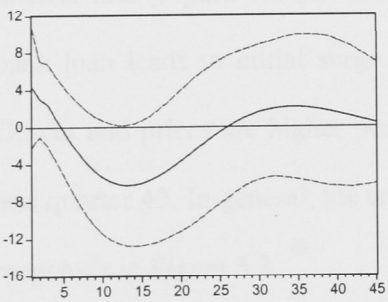
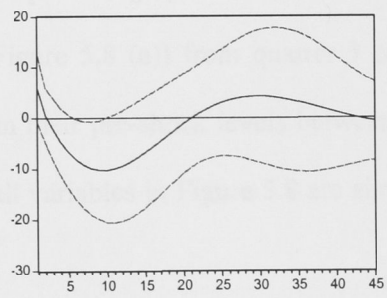


Figure 5.7 (f) Foreign currency loans



Notes: The vertical axes in Figure 5.7 (a), 5.7 (b), 5.7 (c) and 5.7 (f) are in per cent, and in Figure 5.7 (c) and 5.7 (d) are in percentage point. The horizontal axes are in quarter.

Source: Author's calculations.

The movement and magnitude of output, prices and bank loans in Vietnamese dong and US dollar reactions in Figure 5.7 are similar to their responses in Figure 5.3. The shock in the US dollar interest rate lead to a drop in output, prices from quarter 1 to quarter 20. Bank loans rise initially due to contract commitments between banks and firms. However, the increase in the US dollar lending interest does not induce an increase in the VND lending interest rate (Figure 5.7 (c)). The gradually deregulation of bank lending interest rates in Vietnamese dong and foreign currencies in the period 1999 – 2003 may be a reason for this phenomenon[46]. Therefore, the increase of the VND interest rate after a rise in the US dollar interest rate in Figure 5.3 (c) might be more reasonable.

Figure 5.8 shows the movements of all variables after unexpected rise of 1 percent in bank lending in Vietnamese dong (Figure 5.8 (e)). Foreign currency loans (Figure 5.8 (f)) rise 0.7 per cent after the increase in VND bank loans. As a result, the US dollar lending interest rate (Figure 5.8 (d)) goes up 0.01 percentage point. In contrast, the VND lending interest rate (Figure 5.8 (c)) is lower by 0.02 percentage point. The increase supply of bank loan leads to initial surge in output (Figure 5.8 (a)) from quarter 1 to quarter 5. Output and prices are higher persistently than their pre-shock levels between quarter 20 and quarter 40. In general, the responses of all variables in Figure 5.8 are similar to their responses in Figure 5.3

[46] The deregulation process of interest rates is presented in Chapter 3 section 3.3.

Figure 5.8 **Impulse responses to an unexpected increase in VND bank loans**

Figure 5.8 (a) Output

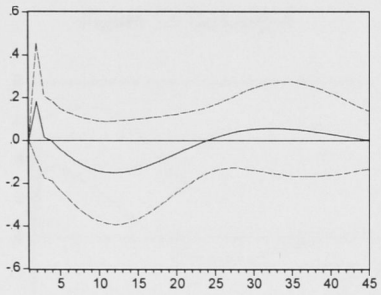


Figure 5.8 (b) Prices

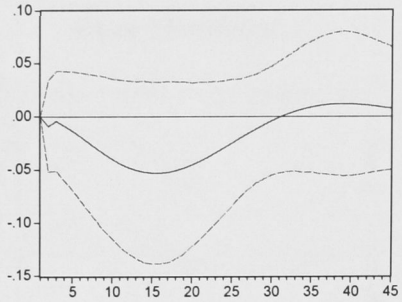


Figure 5.8 (c) VND interest rate

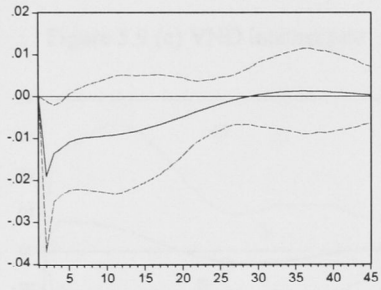


Figure 5.8 (d) USD interest rate

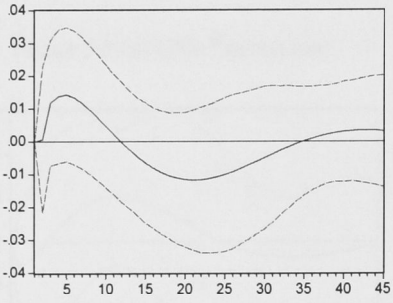


Figure 5.8 (e) VND loans

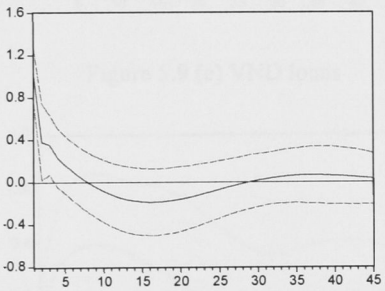
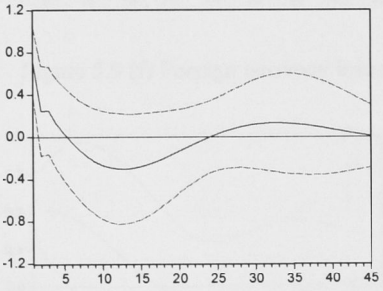


Figure 5.8 (f) Foreign currency loans



Notes: The vertical axes in Figure 5.8 (a), 5.8 (b), 5.8 (c) and 5.8 (f) are in per cent, and in Figure 5.8 (c) and 5.8 (d) are in percentage point. The horizontal axes are in quarter.

Source: Author's calculations.

Figure 5.9 presents the reactions of all variables in the model to an increase of 1 per cent in bank lending in foreign currencies. Overall, the reactions of all variables in Figure 5.9 are similar to their responses in Figure 5.5.

Figure 5.9 **Impulse responses to an unexpected increase in foreign currency bank loans**

Figure 5.9 (a) Output

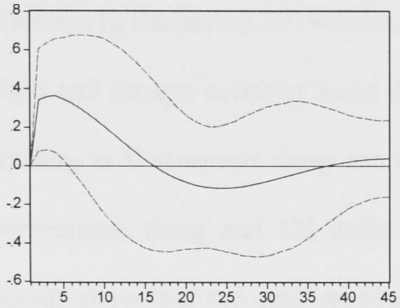


Figure 5.9 (b) Prices

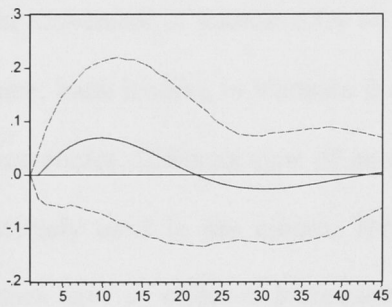


Figure 5.9 (c) VND interest rate

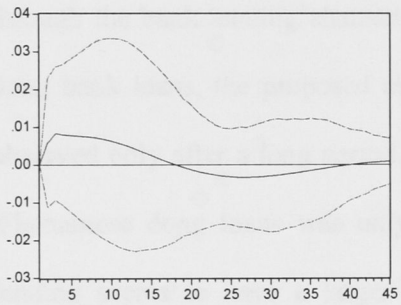


Figure 5.9 (d) USD interest rate

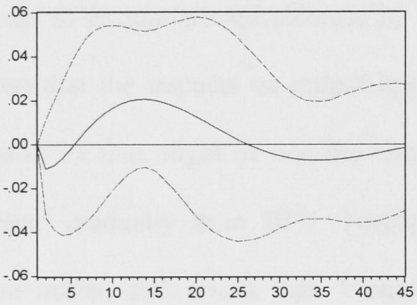


Figure 5.9 (e) VND loans

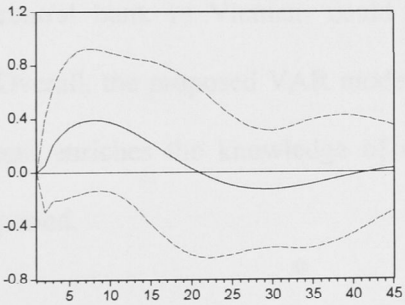
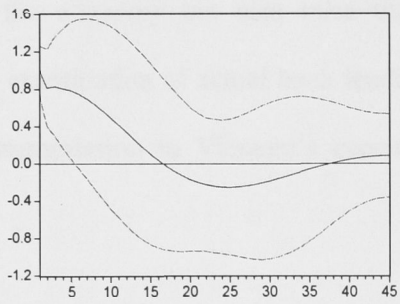


Figure 5.9 (f) Foreign currency loans



Notes: The vertical axes in Figure 5.9 (a), 5.9 (b), 5.9 (c) and 5.9 (f) are in per cent, and in Figure 5.9 (c) and 5.9 (d) are in percentage point. The horizontal axes are in quarter.

Source: Author's calculations.

5.4 Concluding remarks

The VAR model presented in this paper attempts to analyze the bank lending channel in Vietnam in the period 1999-2006. Because the movement of interest rates on Vietnamese dong and foreign currency loans is not the same, bank lending in Vietnam is divided into lending in Vietnamese dong and in foreign currencies. Different type of interest rates in Vietnamese dong and US dollar are alternatively used in the model. The estimation results show that the bank lending channel does have an effect in increasing output and prices. The impact of changes in interest rates on output and price level is augmented through the bank lending channel. In the case of an unexpected increase in Vietnamese dong bank loans, the proposed model shows that the impacts on output and prices are observed only after a long period. The reason for that might be that the interest rate on Vietnamese dong loans was only deregulated gradually from 2001. Foreign currency lending seems to have a larger impact on output and prices than Vietnamese dong lending. The finding suggests that the loosening monetary policy implemented by the central bank in Vietnam could stimulate the economy but also raise the inflation. Overall, the proposed VAR model offers an examination of actual bank lending channel and enriches the knowledge of monetary transmission in Vietnam's economy in this period.

CHAPTER 6 CONCLUSION

6.1 Summary of findings

The thesis analyzes several issues relating to the monetary transmission process in Vietnam in period 1999-2006. First the thesis shows that since 1999 the reform in banking sector in Vietnam has allowed monetary policy to achieve its role in the economy. The relationship between dollarisation and other major economic variables, such as output and inflation, is also investigated in the model. Because of the dollarization situation in Vietnam the monetary aggregate is divided into two components: domestic monetary aggregates and foreign currency deposit. The domestic US dollar interest rate is also included in the model. However, the structural vector autoregressive model with a recursive assumption seems not to reflect properly the monetary transmission process in this period. To solve the 'puzzles' a structural vector autoregressive model that allows for non-recursive contemporaneous identification is used. The identification scheme proposed in the research appears to offer satisfactory results. No evidence of the 'price puzzle' or 'liquidity puzzle' is found.

The main finding suggests that the loosening of domestic monetary policy implemented by the central bank after the Asian Financial Crisis did bring the expected results: output increased and the inflation rose as well. The interest rate appears to be the main policy instrument for the central bank in Vietnam. Dollarization in the Vietnam's economy also had an impact on the transmission process. Thus, it is necessary to consider the impact of the movements of foreign currency deposits in the banking system and the domestic USD

rate in analyzing monetary transmission mechanism. However, the impulse response of Vietnamese dong interest rate after a tightening in domestic US dollar interest rate suggests that the central bank in Vietnam is still able to maintain independent monetary policy. The bank lending channel seems to enhance the impact of changes in monetary policy on output and inflation. The lagged positive responses of output and price level to an increase in bank lending in Vietnamese dong suggest that the central bank should be cautious in expanding lending activity to stimulate the economy. Overall, the findings in this research show that impacts of monetary policy on main economic variables in the period 1999-2006 are consistent with theory. The findings also justify the central bank action after the Asian Financial Crisis to use monetary policy in stimulating the economy. However, this policy also raised inflation and dollarization in this period. Therefore, in managing monetary policy the central bank should not only pay attention to achieve short-term targets but also need to consider long term impacts.

6.2 Limitations and suggestions for further studies

Overall, the research undertaken in this thesis is subject to certain limitations, in particular is the data availability. The empirical results in this thesis provide some suggestions for the central bank in Vietnam to analyze the impacts of monetary policy. However, to make policy decisions in reality these results should be used carefully, particularly for forecasting.

The nonstationary of data and the use of a structural vector autoregressive model might be questionable although the thesis does explain that the estimation of VAR in levels still provides consistent estimates and using all available information. Furthermore, the stability of the VAR model suggests that the estimation results as reflected in the impulses response analysis are valid. The convergence of all variables in the model after the shocks occur also supports the validity of the results.

At this point, data on bank credit are not available in sufficient detail to investigate the effect of the credit channel in Vietnam following the approach proposed by Bernanke and Blinder (1998). Thus, future studies on the impact of credit channel in the transmission process using on this approach would be useful. The rapid increases in number of equitised firms and market value of stock exchange in Vietnam also suggest that asset price channel could become an important channel in monetary transmission mechanism. Furthermore, a comparison of the monetary transmission mechanism across economies which experience dollarisation and pegged exchange rate regimes could provide further policy implications on the issue of monetary transmission in those economies.

Appendix A.1 Structural vector autoregression model

A.1.1 SVAR model

We can express the VAR model in short forms as follow (for simplifying, intercept terms and exogenous variables are omitted)

$$X_t = B_0X_t + B_1X_{t-1} + ... + B_pX_{t-p} + \varepsilon_t \qquad (1)$$

Where $X_t = \begin{bmatrix} y_{1t} \\ y_{2t} \\ \cdots \\ y_{nt} \end{bmatrix}$ is an n x 1 vector of variables at time t,

B_i for i = 0, 1,…., p are n x n matrix of coefficients,

and $\varepsilon_t = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \cdots \\ \varepsilon_{nt} \end{bmatrix}$ is an n x 1 vector of structural shocks and $E(\varepsilon_t\varepsilon'_t) = I$.

For OLS estimation procedure (1) is modified as follows:

$$(1 - B_0)X_t = B_1X_{t-1} + ...+B_pX_{t-p} + \varepsilon_t \qquad (2)$$

Pre-multiplying with matrix $(1 - B_0)^{-1} = A_0$ the reduced form or standard form will be:

$$X_t = A_1X_{t-1} +.....+ A_pX_{t-p} + e_t \qquad (3)$$

where e_t is the n x 1 vector of reduced form residuals with variance-covariance matrix $E(u_tu'_t) = \Omega$; $E(u_iu_j) = 0$: $i \neq j$; $A_i = A_0B_i$, for i = 1,….,p.

In order to have stability of a VAR model or to have a convergent expansion of X_t, it requires that the roots of the system in (3) are less than one in absolute value.

The structural shocks and reduced form residuals are related by

$$e_t = A_0\varepsilon_t \quad (4)$$

$$\Omega = A_0A'_0 \quad (5)$$

(1) and (3) can be manipulated further to get:

$$X_t = [1-B(L)]^{-1}\varepsilon_t \quad (6)$$

and $$X_t = [1-A(L)]^{-1}e_t \quad (7)$$

in which: $B(L)X_t = B_0X_t + B_1X_{t-1} + \ldots.. + B_pX_{t-p}$

$$A(L)X_t = A_1Y_{t-1} + \ldots.. + A_pY_{t-p}$$

From (4), (6) and (7) we can get the impulse to structural shocks by formulating relation:

$$[1-B(L)]^{-1} = [1-A(L)]^{-1}A_0 \quad (8)$$

The variance-covariance matrix Ω obtained from the estimation provide $n(n+1)/2$ restrictions on A_0 (equation 5) and thus, $n(n-1)/2$ additional restrictions are needed for full identification.

Two methods have been used in the VAR literature to identify the structural shocks. The first one is recursive assumption that assuming A_0 is lower triangular and using Choleski decomposition of the matrix Ω. In this recursive model, shocks are transmitted between variables in the system in one-way restriction following the ordering of variables. The second method is non recursive assumption. The non-recursive approach does not require matrix A_0 is lower triangular. Shocks to variables in the system could affect other variables contemporaneously.

A.1.2 Impulse response functions

An important implication of VAR model is to investigate the impulse response functions of variables following shocks to other variables. These shocks are explained as exogenous changes coming from outside the model and uncorrelated with each other. Impulse response functions allow tracing out the time path of various shocks on variable interested. From (7) we can depict the impulse response functions in form of vector moving average as follows:

$$X_t = \mu + \sum_{i=0}^{\infty} \theta_i * \varepsilon_{t-i} = \mu + \sum_{i=0}^{\infty} \begin{bmatrix} \theta_{11}(i) & \theta_{12}(i) & \dots & \theta_{1n}(i) \\ \theta_{21}(i) & \theta_{22}(i) & \dots & \theta_{2n}(i) \\ \dots & \dots & \dots & \dots \\ \theta_{n1}(i) & \theta_{n2}(i) & \dots & \theta_{nn}(i) \end{bmatrix} \begin{bmatrix} \varepsilon_{1t-i} \\ \varepsilon_{2t-i} \\ \dots \\ \varepsilon_{nt-i} \end{bmatrix}$$

in which ε_t is structural shocks, μ is a average value of X_t.

The elements of θi are called impulse response functions, plotting these elements against i is practical way to visually examine the behavior of X_t in response to various shocks.

For i=0 we have $\theta_{12}(0)$ is the instantly impact of a one-unit change in $\varepsilon_{x2\,t}$ on x_{1t}; $\theta_{11}(1)$ is one period response of a one-unit change in $\varepsilon_{x1\,t-1}$ on x_{1t}.

A.1.3 Variance decomposition

Variance decomposition is tool to decompose error variance of one endogenous variable in VAR model by its own shock against shocks of other variables. This is useful tool to represent which shocks significantly contribute to forecast variance of interested variable. Typically, over short forecast periods, the error variance of interested variable is mainly due to its own shock. However, over longer forecast periods, other shocks may become relatively important through the structure of VAR model.

Appendix A.2 Tests of Model 1

Table A.2.1 **Unit root test of data**

Variables	Test for *I(0)* (Levels)	Test for *I(1)* (First differences)	Critical value at 1% level		Critical value at 5% level	
			I(0)	*I(1)*	*I(0)*	*I(1)*
Y	-2.914	-6.940	-4.28	-4.29	-3.562	-3.568
CPI	-2.319	-3.680	-4.28	-4.29	-3.562	-3.568
VND	-3.459	-2.412	-4.28	-4.31	-3.562	-3.574
FCD	-6.764	-3.849	-4.394	-4.29	-3.612	-3.568
RVND	-3.956	-4.000	-4.28	-4.29	-3.562	-3.568
RUSD	-0.317	-3.178	-4.28	-4.34	-3.562	-3.587
EX	-2.116	-4.417	-4.32	-4.35	-3.580	-3.595

Note:

1. Unit root test is Augmented Dickey-Fuller test for all variables being stationary using the following auxiliary regression:

$$\Delta y_t = a_0 + a_1 y_{t-1} + \sum_{i=1}^{p} a_2 \Delta y_{t-i} + a_3 T + \varepsilon_t$$

where y is the variable under consideration and T is a time variable. In estimating the regression, the lag length (p) on the lagged dependent variable was determined to ensure the residual whiteness.

2. Sample period is Q2/1999-Q4/2006.

Source: Author's calculations.

Table A.2.2 **Inverse roots of characteristic polynomial**

Endogenous variables: Y, CPI, VND, FCD, RVND, RUSD

Exogenous variables: Constant, EX.

Lag specification 1 1

Roots	Modulus
0.941037 - 0.095346i	0.945855
0.941037 + 0.095346i	0.945855
0.655928	0.655928
0.560678	0.560678
0.392752 - 0.250204i	0.465678
0.392752 + 0.250204i	0.465678

No root lies outside the unit circle.

VAR satisfies the stability condition.

Table A.2.3 **VAR residual serial correlation LM tests**

H0: no serial correlation at lag order h

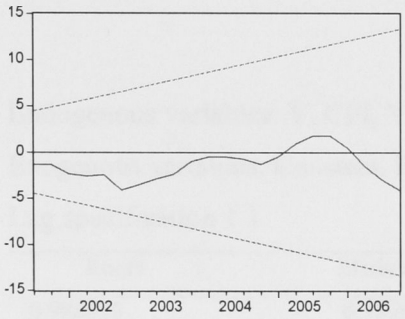
Included observations: 30

Lag	LM Stat	Probability
1	37.23218	0.4121
2	29.52328	0.7687
3	39.51541	0.3158
4	57.05572	0.1425
5	32.13787	0.6529
6	23.72079	0.9422

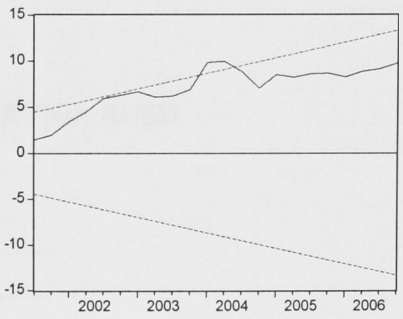
Probabilities are from Chi-square with 36 degrees of freedom.

Figure A.2.1 **Equation stability test** (CUSUM test)

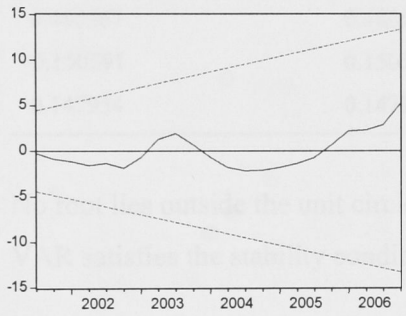
Output



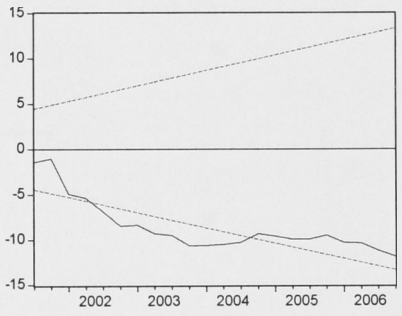
Prices



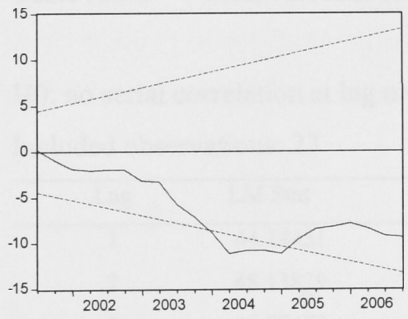
VND monetary aggregate



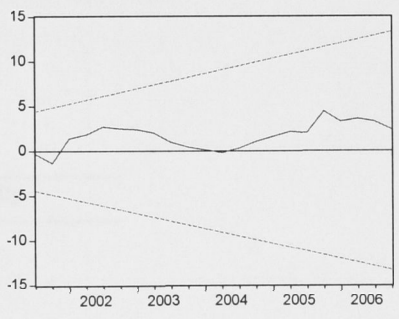
Foreign currency deposits



VND interest rate



USD interest rate



Note: The test for stability is CUSUM test (test of cumulative sum of recursive residuals). The dotted lines are 5 per cent significant lines.

Appendix A.3 Tests of model 3

Table A.3.1 **Inverse roots of characteristic polynomial**

Endogenous variables: Y, CPI, VND, FCD, RVND, RUSD

Exogenous variables: Constant, EX.

Lag specification 1 1

Roots	Modulus
0.986636	0.986636
0.819087 - 0.475389i	0.947047
0.819087 + 0.475389i	0.947047
0.480567	0.480567
-0.150591	0.150591
0.147954	0.147954

No root lies outside the unit circle.

VAR satisfies the stability condition.

Table A.3.2 **VAR residual serial correlation LM tests**

H0: no serial correlation at lag order h

Included observations: 23

Lag	LM Stat	Probability
1	44.28451	0.1617
2	48.13829	0.0850
3	48.87473	0.0745
4	38.14473	0.3721
5	47.06137	0.1026
6	35.37972	0.4979

Probabilities are from Chi-square with 36 degrees of freedom.

Table A.3.3 **Diagnostic tests of each equation in the VAR system**

Diagnostic Test		Y	CPI	VND	FCD	RVND	RUSD
Normality of	JB	7.12	0.023	0.40	0.73	0.62	6.69
Errors		*0.03*	*0.98*	*0.81*	*0.69*	*0.73*	*0.04*
Serial correlation of	F	0.55	0.55	0.38	1.99	0.01	0.35
errors		*0.46*	*0.46*	*0.53*	*0.17*	*0.92*	*0.56*
	LM	0.58	0.59	0.42	1.99	0.01	0.38
		0.44	*0.44*	*0.51*	*0.15*	*0.91*	*0.53*
Heteroskedasticity	F	1.86	0.74	0.69	1.13	0.46	1.38
of errors		*0.17*	*0.69*	*0.73*	*0.43*	*0.90*	*0.31*
	LM	16.7	11.9	11.5	14.2	9.20	15.3
		0.21	*0.53*	*0.56*	*0.35*	*0.75*	*0.28*
Functional form	F	6.34	0.87	1.60	8.21	0.85	0.22
(RESET)		*0.06*	*0.36*	*0.22*	*0.03*	*0.37*	*0.64*
	LL	9.71	1.39	2.50	9.65	1.35	0.35
		0.04	*0.23*	*0.11*	*0.02*	*0.24*	*0.55*

Note:

1. Sample period is Q1/2001-Q4/2006.
2. Definitions of all tests are as explained in Table 4.3 in Chapter 4.

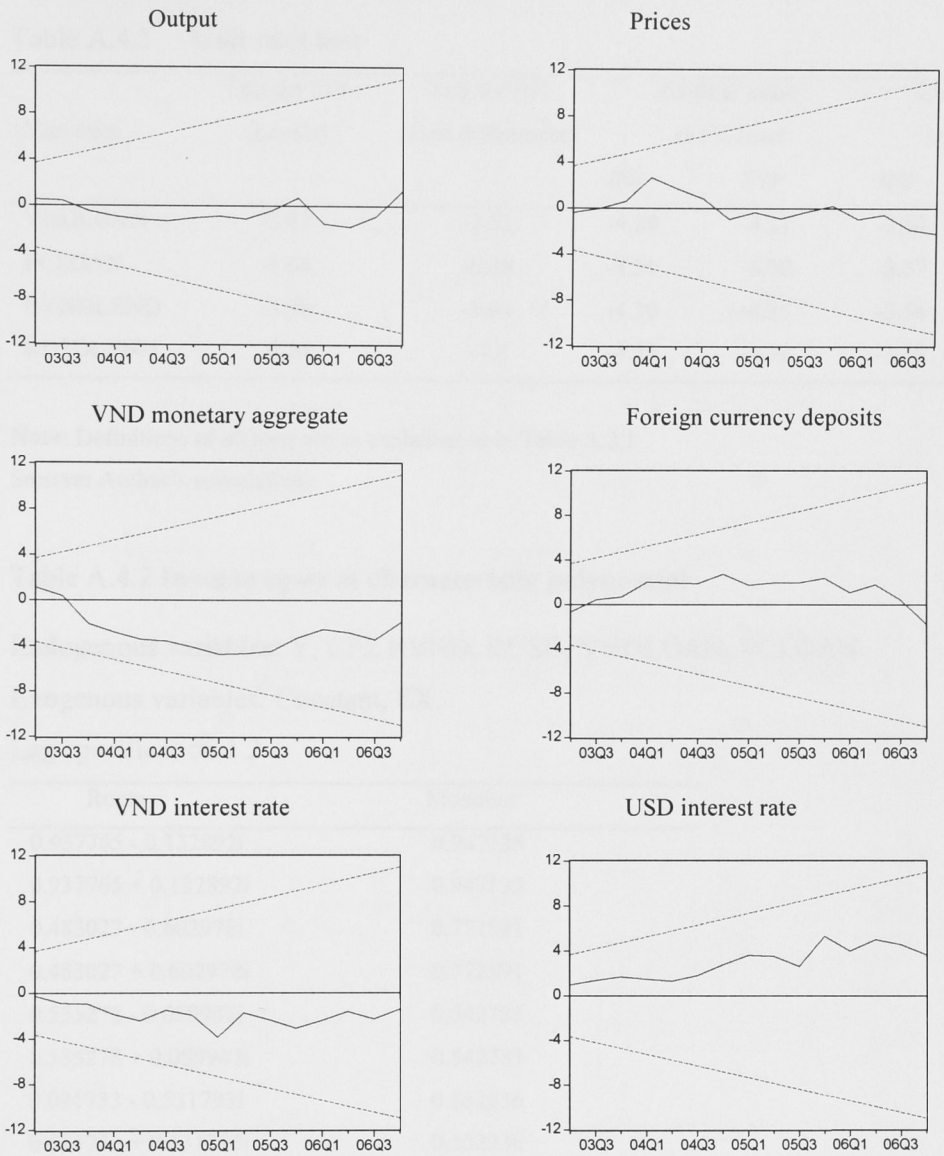
Table A.3.4 **Identifying test of non-recursive VAR model**

$$\begin{bmatrix} \varepsilon_Y \\ \varepsilon_{CPI} \\ \varepsilon_{VND} \\ \varepsilon_{FCD} \\ \varepsilon_{RVND} \\ \varepsilon_{RUSD} \end{bmatrix} = \begin{bmatrix} 1 & & & & & \\ 0.0029 & 1 & & & & \\ -0.467 & -1.185 & 1 & 0.52 & -0.054 & \\ 0.648 & -1.885 & -0.077 & 1 & 0 & -0.055 \\ 0 & 22.513 & 4.30 & 0 & 1 & 0 \\ 0 & 0 & -3.80 & 2.80 & 0.515 & 1 \end{bmatrix} \begin{bmatrix} e_Y \\ e_{CPI} \\ e_{VND} \\ e_{FCD} \\ e_{RVND} \\ e_{RUSD} \end{bmatrix}$$

Log likelihood = 283.47 LR test for over-identification: Chi-square (1) = 0.034 Probability = 0.854

Source: Author's calculations.

Figure A.3.1 Equation stability test (CUSUM test)



Note: The test for stability is CUSUM test (test of cumulative sum of recursive residuals). The dotted lines are 5 per cent significant lines.

Appendix A.4 Tests of model 4

Table A.4.1 **Unit root test**

Variables	Test for *I(0)* (Levels)	Test for *I(1)* (First differences)	Critical value at 1% level		Critical value at 5% level	
			I(0)	*I(1)*	*I(0)*	*I(1)*
VNDLOAN	-3.87	-7.51	-4.29	-4.31	-3.57	-3.57
FCLOAN	-1.64	-6.38	-4.31	-4.30	-3.57	-3.57
RVNDLEND	-3.78	-5.94	-4.30	-4.31	-3.56	-3.57
RUSDLEND	-0.24	-4.2	-4.29	-4.31	-3.56	-3.57

Note: Definitions of all tests are as explained as in Table A.2.1

Source: Author's calculations.

Table A.4.2 **Inverse roots of characteristic polynomial**

Endogenous variables: Y, CPI, RVND, RUSD, VNDLOAN, FCLOAN

Exogenous variables: Constant, EX.

Lag specification 1 2

Roots	Modulus
0.937765 - 0.132892i	0.947135
0.937765 + 0.132892i	0.947135
0.483027 - 0.602978i	0.772591
0.483027 + 0.602978i	0.772591
0.535278 - 0.089947i	0.542783
0.535278 + 0.089947i	0.542783
0.021733 - 0.531793i	0.532236
0.021733 + 0.531793i	0.532236
-0.474203 - 0.231579i	0.527729
-0.474203 + 0.231579i	0.527729
0.285377 - 0.047545i	0.289310
0.285377 + 0.047545i	0.289310

No root lies outside the unit circle. VAR satisfies the stability condition.

Table A.4.3 **VAR residual serial correlation LM tests**

H0: no serial correlation at lag order h

Included observations: 29

Lag	LM Stat	Probability
1	34.47642	0.5411
2	31.56844	0.6793
3	28.88246	0.7943
4	43.02360	0.1958
5	46.58332	0.1113
6	24.90899	0.9179

Probabilities are from Chi-square with 36 degrees of freedom.

Table A.4.4 **Diagnostic tests of each equation in the VAR system**

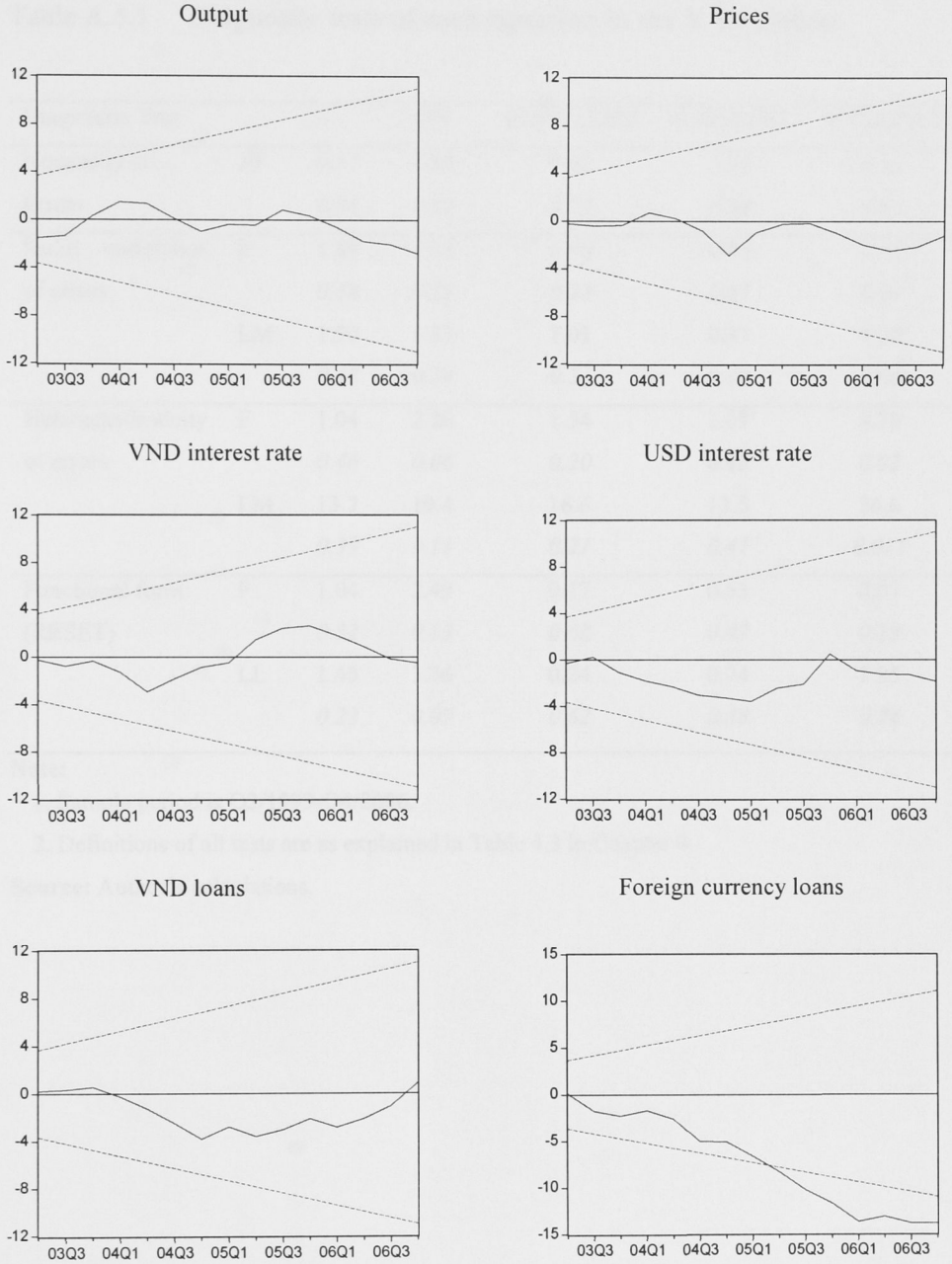
Diagnostic Test		Y	CPI	RVND	RUSD	VNDLOAN	FCLOAN
Normality of	JB	1.77	4.53	2.96	7.70	1.04	1.69
Errors		*0.41*	*0.11*	*0.23*	*0.02*	*0.59*	*0.43*
Serial correlation of	F	1.10	0.13	0.02	0.35	0.19	0.10
errors		*0.30*	*0.72*	*0.89*	*0.56*	*0.66*	*0.75*
	LM	1.13	0.14	0.02	0.37	0.20	0.11
		0.28	*0.70*	*0.88*	*0.54*	*0.65*	*0.74*
Heteroskedasticity	F	0.32	0.98	8.37	1.16	0.99	0.46
of errors		*0.95*	*0.59*	*0.05*	*0.52*	*0.59*	*0.88*
	LM	21.1	25.8	28.5	26.3	25.8	23.05
		0.68	*0.41*	*0.28*	*0.39*	*0.41*	*0.57*
Functional form	F	0.54	0.37	1.90	0.75	0.64	4.87
(RESET)		*0.37*	*0.55*	*0.19*	*0.39*	*0.43*	*0.04*
	LL	0.78	0.75	3.7	1.52	1.30	6.35
		0.37	*0.38*	*0.06*	*0.21*	*0.25*	*0.02*

Note:

1. Sample period is Q2/1999-Q4/2006.
2. Definitions of tests are as explained in Table 4.3 in Chapter 4.

Source: Author's calculations.

Figure A.4.1 **Equation stability test** (CUSUM test)



Note: The test for stability is CUSUM test (test of cumulative sum of recursive residuals). The dotted lines are 5 per cent significant lines.

Appendix A.5 Tests of model 5

Table A.5.1 **Diagnostic tests of each equation in the VAR system**

Diagnostic Test		Y	CPI	RVNDLEND	RUSDLEND	VNDLOAN	FCLOAN
Normality of	JB	0.17	0.35	0.62	0.74	0.11	1.13
Errors		*0.91*	*0.83*	*0.73*	*0.69*	*0.95*	*0.56*
Serial correlation	F	1.89	1.33	0.98	0.45	4.57	4.11
of errors		*0.18*	*0.25*	*0.33*	*0.51*	*0.04*	*0.052*
	LM	1.90	1.37	1.01	0.47	4.20	3.83
		0.17	*0.24*	*0.31*	*0.49*	*0.04*	*0.05*
Heteroskedasticity	F	1.04	2.26	1.54	1.01	8.70	6.27
of errors		*0.46*	*0.06*	*0.20*	*0.48*	*0.02*	*0.04*
	LM	13.7	19.4	16.6	13.5	26.6	25.1
		0.39	*0.11*	*0.21*	*0.41*	*0.014*	*0.02*
Functional form	F	1.04	2.49	0.17	0.53	0.97	4.94
(RESET)		*0.32*	*0.13*	*0.68*	*0.47*	*0.33*	*0.04*
	LL	1.45	3.36	0.24	0.74	1.35	6.34
		0.23	*0.07*	*0.62*	*0.38*	*0.24*	*0.01*

Note:

1. Sample period is Q2/1999-Q4/2006.
2. Definitions of all tests are as explained in Table 4.3 in Chapter 4.

Source: Author's calculations.

Table A.5.2 **Inverse roots of characteristic polynomial**

Endogenous variables: Y, CPI, RVNDLEND, RUSDLEND, VNDLOAN, FCLOAN

Exogenous variables: Constant, EX.

Lag specification 1 1

Roots	Modulus
0.939228 - 0.140650i	0.949701
0.939228 + 0.140650i	0.949701
0.888463	0.888463
0.463915	0.463915
0.297588	0.297588
-0.236293	0.236293

No root lies outside the unit circle.

VAR satisfies the stability condition.

Table A.5.3 **VAR residual serial correlation LM tests**

H0: no serial correlation at lag order h

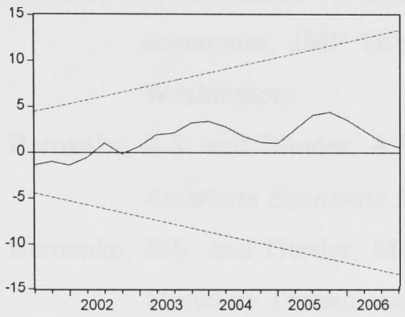
Included observations: 30

Lag	LM Stat	Probability
1	49.74618	0.0634
2	39.76804	0.3059
3	30.69250	0.7189
4	47.69130	0.0920
5	61.72799	0.0480
6	41.36050	0.2481

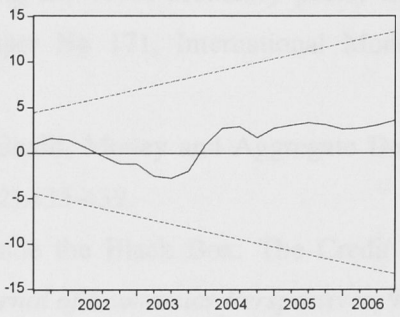
Probabilities are from Chi-square with 36 degrees of freedom.

Figure A.5.1 **Equation stability test** (CUSUM test)

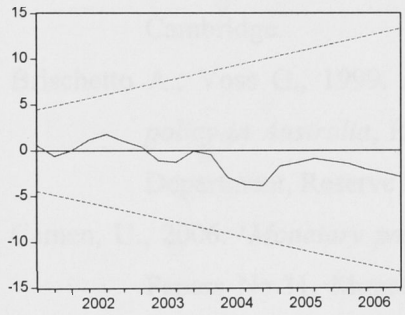
Output



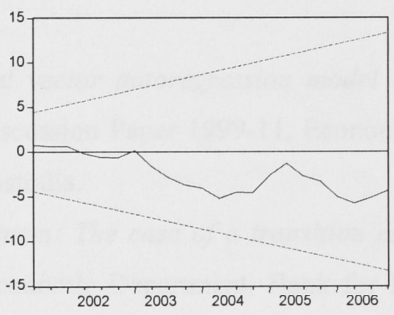
Prices



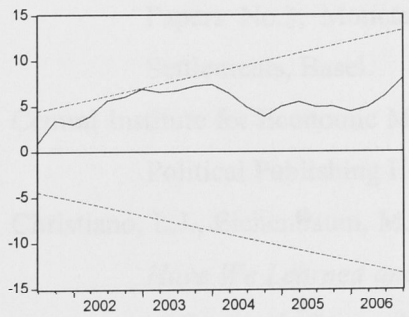
VND lending interest rate



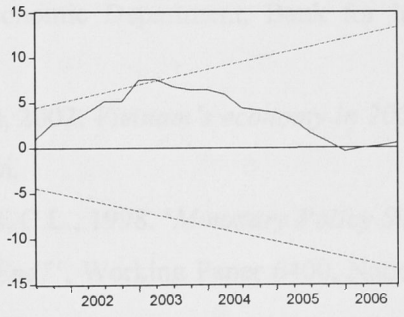
USD lending interest rate



VND loans



Foreign currency loans



Note: The test for stability is CUSUM test (test of cumulative sum of recursive residuals). The dotted lines are 5 per cent significant lines.

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